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" 402.—'Some Chinese Fresh-water Fishes.' By J. T. Nichols. 4 pp. (Two text figures.) February 28, 1930.

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" 404.—'New Species of *Lepidanthrax* and *Parabombylius* (Bombyliidæ, Diptera).' By C. H. Curran. 7 pp. February 28, 1930.

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ERRATA

No **402** Page 3, Fig 2, for *Mycropercops* read *Micropercops*
403. Page 16, line 9 from top, for form read from
405 Page 8, line 13 from bottom, for *basilaris* read *basilare*
405 Page 12, line 18 from bottom, for *basilaris* read *basilare*
‘ **407.** Page 1, line 3 from top, for expedtions read expeditions
‘ **410.** Page 4, line 25 from top, for line of blackish read blackish line
411. Page 5, line 19 from bottom, for *atrimanus* read *atrimana*
411. Page 7, line 17 from top, for *neomorum* read *nemorum*

No. **412.** Page 1, line 16 from top, for *pygmea* read *pygmeus*.
" **413.** Page 4, line 9 from bottom, for *hiritipes* read *hirtipes*.
" **415.** Page 1, line 16 from top, for froms read forms.
" **415.** Page 2, last line, for *brevistylatus* read *brevistylata*.
" **420.** Page 9, in Table 2, line 19, last column, for -7 read 8.
" **420.** Page 9, in Table 2, line 20, last column, for 56 read - 58.
" **420.** Page 9, in Table 2, line 22, last column, for 34 read -57.
" **421.** Page 26, line 12 from top, for *horozontalis* read *horizontalis*.
" **424.** Page 6, Fig. 14, for sitgmatic read stigmatic.
" **425.** Page 2, line 15 from bottom, for additinoal read additional.
" **425.** Page 5, line 3 from bottom, for varrying read varying.
" **433.** Page 13, line 15 from top, for margnial read marginal.
" **434.** Page 8, Table I, line 3 from bottom (footnote) for *marima* read *maxima*.
" **437.** Page 1, Library number, for 56.9, 3 (117:51.7) read 56.4, 3 (117:51.7).
" **454.** Page 11, Table, last column, for *zuelma* read *zulema*.
" **455.** Page 6, line 20 from top, for *L. spendens* read *splendens*.
" **456.** Page 1, line 11 from bottom, left-hand column, for *Erax fœorbesi* read *Erax forbesi*.
" **459.** Page 2, line 7 from top, for *kholobolchiensis* read *mongoliensis*.
" **459.** Page 7, line 8 from bottom, for *kholobolchiensis* read *mongoliensis*.
" **459.** Page 10, Fig. 7, for *Eudinoceras kholobolchiensis* read *Eudinoceras mongoliensis*.
" **459.** Page 12, Fig. 10, for *Eudinoceras kholobolchiensis* read *Eudinoceras mongoliensis*.
" **460.** Page 15, line 12 from top, omit word all.

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THE FOSSIL FROGS OF THE INTERTRAPPEAN BEDS OF BOMBAY, INDIA

By G. K. Noble

In a series of papers (1924, 1925, 1926, 1928) I have presented evidence that the present distribution of the frogs and toads could be explained without assuming that land bridges formerly existed in the southern hemisphere connecting South America with Australia or the latter with Africa. Metcalf (1923, 1923*a*), in discussing the distribution of the opalinid parasites of the Salientia, found it convenient to postulate extensive continental connections to account for his views of the dispersal of the latter. In a recent review (1929) of the same subject he has reiterated these views without giving consideration to the many objections which have been raised against them. Unfortunately the fossil record of the Salientia is very incomplete, but where it exists any theory of dispersal must be made to conform with it. Fossil frogs have been known from the Eocene beds of Bombay, India, for a long time. They were described by Owen (1847) as *Rana pusilla*, while Stoliczka (1869), after an examination of a series of specimens, referred them to *Oxyglossus*. The latter genus has a wide distribution to-day in southeastern Asia and adjacent islands. In view of the importance of fossil material in the present controversy, it seemed important to reexamine the available material of the species. The study was made possible by the kindness of Mr. Jayme Ribeiro who has loaned to the American Museum a collection of fifteen fossil-bearing slabs, and through the interest of Mr. W. E. Swinton of the British Museum, who has placed at my disposal the five specimens of the species in the British Museum.

A reexamination of this early described species of fossil frog also seemed advisable, because, if the facts set forth by Stoliczka (1869) were correct, the species would be the type of a well-defined new genus of frogs. Stoliczka (loc. cit., pp. 387–389) states:

"The nasals, frontals, parietals and occipitals are united to a single long and broad bone, without being distinguishable in any of the specimens examined. . . . The anterior prolongations of the frontals appear to be perfectly ossified, and united to the corresponding processes of the maxillaries. . . . Of the sternal bones nothing could be seen; they were probably not ossified."

I have not examined the type of *Rana pusilla*, but as some of the specimens in the British Museum collections were obtained by Mr. A. B. Wynne, the collector of Stoliczka's material, it seems probable that Stoliczka examined the British Museum specimens. Only one species of frog has been recorded from any of the Bombay Beds, and all of the recorded specimens come apparently from the same strata. We have, therefore, every reason to believe that the specimens available are referable to one species, the same which Owen and Stoliczka described. A detailed account of the beds from which the Ribeiro collection was obtained has been published by Ribeiro (1921). My thanks are due to Mr. S. H. Prater of the Bombay Natural History Society for calling my attention to this reference as well as for securing the loan of the Ribeiro collection.

Although there is great variability in the extent and character of the fossilization in the different specimens of both the Ribeiro and British Museum collections, there is no definite evidence that the series embraces more than one species of frog. The species cannot be referred to *Oxyglossus*, or *Oxydozyga*, as the genus is now called, because among the several conspicuous differences the sacral diapophyses are definitely dilated. This character was not noted by either Owen or Stoliczka, both of whom figured the pelvis. My material has been examined in oil of cedarwood or in xylol, with the help of a binocular microscope. Such treatment brings into view features not observable in the dry specimens. The many differences between the detailed description of Stoliczka (1869) and that given below seem due chiefly to the different methods of study. The material available to me is fragmentary but sufficient to show that the species must be removed not only from the genus *Oxyglossus* but also from the Ranidæ. It is interesting from the zoögeographic standpoint that I can find no characters to separate it from certain Australian bufonids.

Bufonidæ

Indobatrachus, new genus

TYPE.—*Indobatrachus pusillus* (Owen).

DIAGNOSIS.—Teeth on the maxillaries, premaxillaries and prevomers, none on dentaries; nasal and probably palatine bones present, the former free from adjacent elements; frontoparietals separated for the greater part of their length by a broad median fontanel, ethmoid broad and apparently unossified, squamosals small, each with an anteriorly directed process, parasphenoid T-shaped; vertebral column

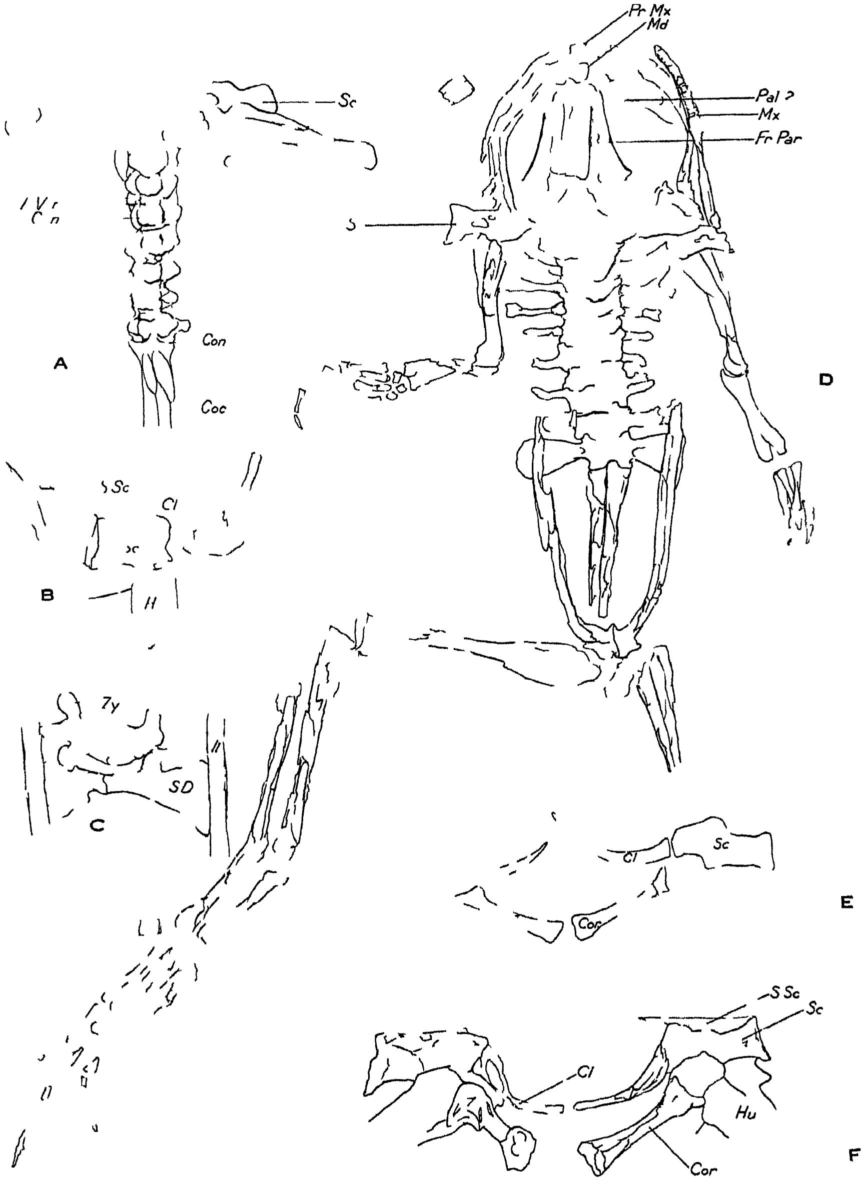

Fig 1 *Indobatrachus pusillus* (Owen), parts of several specimens
(a) Vertebral column ventral surface B M 3084 ×5 2
(b) Part of right half of pectoral girdle R C 10 ×7 8
(c) Fragmentary sacrum R C 3 ×7 8
(d) Outline of B M 35107*a* × 5 2
(e) Fragmentary pectoral girdle R C 9 (reverse surface) ×7 8
(f) Fragmentary pectoral girdle B M 39185*b* ×7 8
See List of abbreviations page 13

uniformly procœlous, but the intercentra more or less free from the body of the vertebræ in one specimen; nine vertebræ anterior to the coccyx; vertebræ with well marked zygapophyses; sacral diapophyses dilated; no ribs; coccyx without lateral processes; two condyles on the coccyx; pectoral girdle arciferal, or at least the clavicle which is arched diverges from the coracoid; coracoid narrow, the two ends of nearly the same width, no ossified omosternum or sternum; scapula about half as long as the humerus, suprascapula about twice as long as the scapula and well ossified; puboischium small, no prepubis; terminal phalanges long and tapering, with very small knobs on ends; no intercalary cartilages, radius and ulna fused, tibia and fibula fused, tibiale and fibulare free; on enlarged prehallux or prepollex; femur as long as tibia, about as long as vertebral column exclusive of the coccyx, head of femur a calcified ball.

COMPARISONS

When the entire series of specimens available for the above diagnosis are considered, certain characters reappear in different specimens, diminishing the chance of faulty interpretation of the material. In making comparisons between *Indobatrachus* and other genera, reference may be made to the specimens which show most clearly the characters in question. *Indobatrachus* is not a liopelmid, for it has only eight presacral vertebræ (B. M. 35107, Fig. I, D), no ribs (R. C. 7*a*, 10), and two condyles to the coccyx (R. C. 3, 4*a*, 6*a*, 7*a*, 10; B. M. 39485). It is not a discoglossid for no ribs are present and the vertebræ are definitely procœlous (R. C. 4*a*, 5, 8*a*, 9; B. M. 39485). The procœlous condition, also, excludes *Indobatrachus* from the Pipidæ. It is not a pelobatid, because two condyles are definitely present on the coccyx. It is not a ranid or a polypedatid, for it possesses broadly expanded sacral diapophyses. Leaving aside the Brachycephalidæ, which embrace a modern, neotropical group of genera, and the Palæobatrachidæ, because of their distinctive sacrum, there remain only the Bufonidæ, Hylidæ and Brevicipitidæ to consider. The Hylidæ may be definitely ruled out, for in several specimens (R. C. 3, 4, 10, B. M. 35107, 39485)the digits are well preserved, and no intercalary cartilages or space for the same are present. The question of whether *Indobatrachus* is a bufonid or brevicipitid rests chiefly on the character of the pectoral girdle. Several specimens of the series of fossils (R. C. 3, 4*a*, 5, 6*a*, 9, 10; B. M. 39485, 35107) show definitely that the clavicle was arched. A few firmisternal genera have arched clavicles (compare Noble and Parker 1926) but in the great majority of ranids the clavicle is straight as in *Rana*. On the other hand, the arched clavicle is characteristic of the arciferal pectoral girdle. In no specimen are the cartilages of the pectoral girdle indicated, but in several the coracoids are present, and in no case do their mesial ends meet in

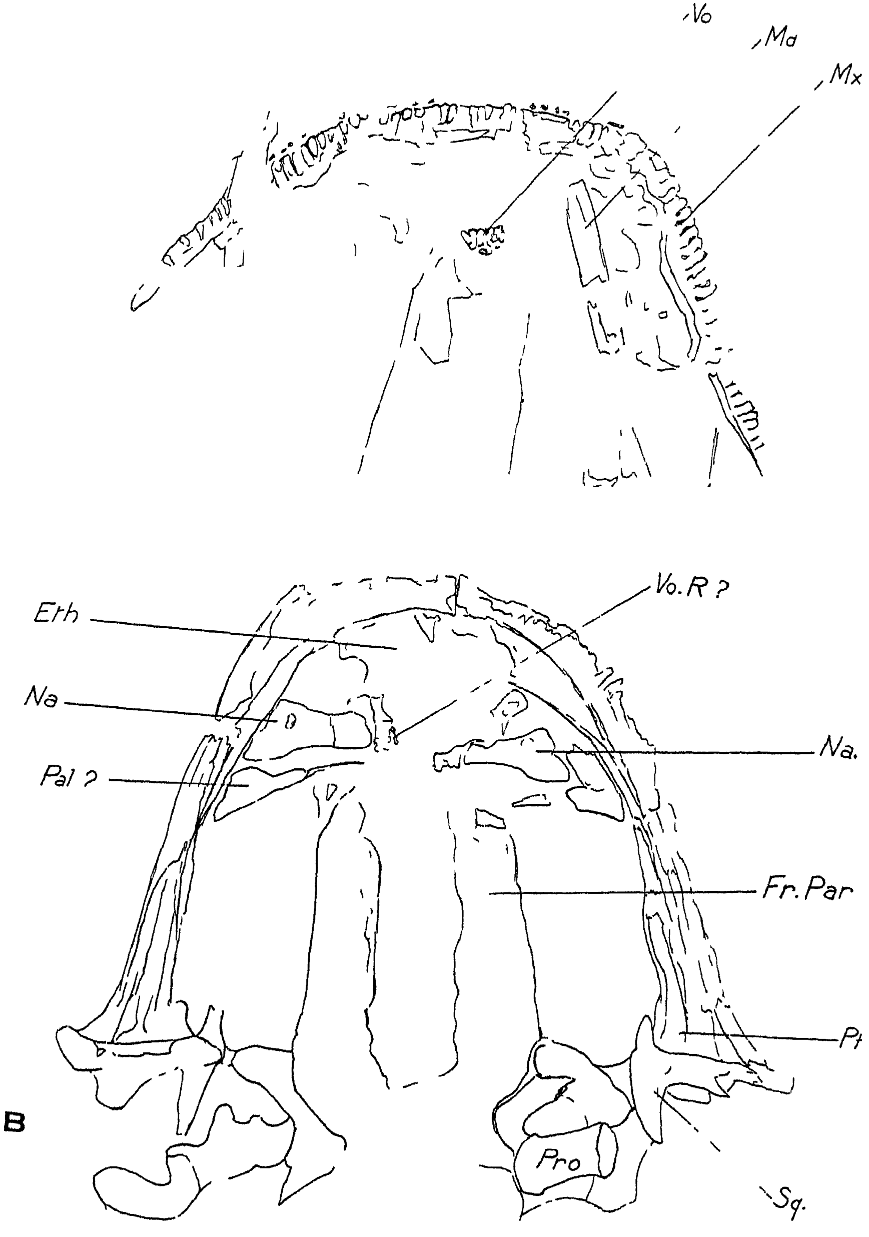

Fig. 2. Diagnostic characters of *Indobatrachus pusillus* (Owen), shown in two skulls.

(a) B. M 39485*b* ×13.
(b) R. C 3 ×13
See list of abbreviations, page 13

the manner typical of the firmisternal girdle Two of the best preserved pectoral girdles are represented in figures 1, E, 1, F In six other specimens (R C 3, 4*a*, 5, 6*a*, and two fossils of B M 35107) the coracoid and clavicle of at least one side are preserved, and these diverge in nearly

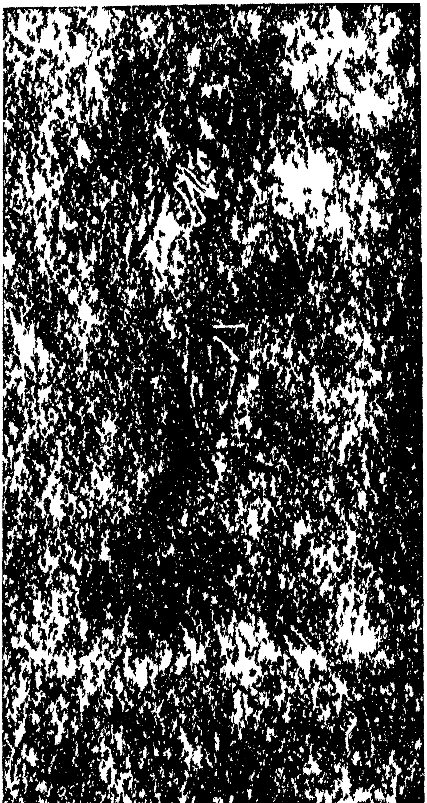

Fig 3 Photograph of *Indobatrachus pusillus* (Owen), R C 3 X3 1 The outline of one sacral diapophysis, and of one half the pectoral girdle, have been drawn in white

the same degree as R C 9 shown in figure 1, E There can be no doubt, therefore, but that the diverging coracoid and clavicle are characteristic of *Indobatrachus* This is a character which distinguishes the arciferal girdle from most firmisternal girdles Further evidence that *Indoba-*

trachus is a bufonid and not a brevicipitid is to be found in the vertebral column. In two specimens (R. C. 6*a*, 8) the sacral vertebra is definitely procœlous, while in several others there is some indication of this procœlous condition (Fig. 1, D). This would seem to exclude *Indobatrachus* at once from the Brevicipitidæ. There are, however, a few brevicipitid genera which retain the primitive procœlous condition of this vertebra instead of having it convex anteriorly as in most brevicipitids. In one specimen of *Indobatrachus* (B. M. 3084), which differs from the others in having an extensive replacement by calcite, the vertebral column has a distinctive appearance (Fig. 1, A). The intervertebral part of each vertebra, instead of being attached to the body of the vertebra as in most frogs, remains more or less free. This suggests that the intervertebral elements were more or less free in life. Among Salientia such a condition is known elsewhere only in some oriental pelobatids and in many Australian bufonids, where, however, the more usual condition is for the intervertebral disks not to be split but to form a single ball between the two centra. Another feature which stamps *Indobatrachus* as closely related to the Australian bufonids is the combination of maxillary teeth and dilated sacral diapophyses. Among the Bufonidæ only a few neotropical genera exhibit the two latter characters at the same time. In brief, although the fossil remains of *Indobatrachus* are not well preserved, the material available definitely excludes this genus from all families of Salientia other than the Bufonidæ and the Brevicipitidæ. The form of the clavicle, the divergence of clavicle and coracoid, the procœlous sacrum and the occasionally free intercentral disks point to *Indobatrachus* as a bufonid and not a brevicipitid. As *Indobatrachus* possesses teeth in the upper jaw, it would be referred to the "Cystignathidæ" or "Leptodactylidæ" of earlier classifications. No toothed bufonids have dilated sacral diapophyses, except the Australian genera and a few neotropical forms: *Paludicola, Eupemphix* and *Calyptocephalus*. If our interpretation of the shoulder girdle as arciferal is correct, *Indobatrachus* is a bufonid, closely related to the Australian genera.

DISCUSSION

The description given above differs radically from the account of Stoliczka of presumably some of the same material in many details, especially those of the skull, pectoral girdle, and sacrum. The evidence on which my statements are based may therefore be discussed in further detail.

The presence of vomerine teeth is deduced from two specimens, both of which are represented by drawings. In B. M. 39485 three sockets for teeth are clearly indicated on the left prevomer, and there is some indication of two other sockets. In R. C 3, the dorsal aspect of the skull is exposed, but the whole skull has been crushed flat, and several ventral structures, such as what appear to be the palatines, lie in the same plane as the frontoparietals. I interpret two roughened bones lying in the vomerine region as the prevomers viewed from their dorsal aspect. In most specimens the maxillary teeth are for the most part lost, only the sockets remaining. Hence, the presence of sockets without teeth would be expected in the vomerine region of these same specimens. The skulls are for the most part poorly preserved in all the specimens. There can be scarcely any doubt, however, as to my identification of the nasals, ethmoid and prootic in this specimen (Fig. 2, B).

The sacrum was described as subcylindrical by Owen, and as club-shaped by Stoliczka. The sacral diapophyses are well preserved in a number of the specimens before me, and there can be no doubt that they are as much dilated as in many Australian bufonids, and more so than in any ranid. This fact alone demands the removal of the species from the Ranidæ. The form of the sacrum, clavicle and coracoid alone shows that the species could not be referred to *Oxyglossus*. In addition, the presence of vomerine teeth and the probable arciferal condition of the girdle exclude it from this genus. *Pusillus* is a small, large-headed frog, which, to judge from the formation in which it was found, apparently had aquatic habits. The various similarities in size and proportion between this species and the several forms of *Oxyglossus* cannot be taken as evidence of relationship. In many families of Salientia there are small aquatic frogs.

From the material available, it is impossible to state in exactly what characters *Indobatrachus* differs from the several Australian genera of toothed bufonids. It shows resemblance to *Crinia*, *Hyperolia*, *Adelotus*, *Philoria* and *Cryptotis*. These genera are distinguished from one another principally by the form of the pupil, the size of the sternum and other details not preserved in *Indobatrachus*. Frogs usually make poor fossils and even the best specimen in the Ribeiro collection (Fig. 3) is far from complete. Further, *Indobatrachus* was a small and very fragile form. The following measurements of R. C. 3 may be taken as an average size.

Tip of snout to posterior end of ischium. . .	19 mm.
Tip of snout to posterior angle of jaw. . . .	6 5 mm.
Length of humerus. .	4 5 mm
Length of femur.	6 5 mm.
Tip of ilium to posterior edge of acetabulum. . . .	6 5 mm.

THE STATUS OF *Lithobatrachus*

The presence of a toothed bufonid in the Eocene of India lends support to the theory of a northern origin of the Australian frog fauna. Recently I described a fossil frog from the Miocene of Europe which gave additional support to this theory (Noble, 1928). As in the case of *pusillus*, the species was based upon material known for a long time but previously interpreted incorrectly. I referred the species to *Hyla*, a genus hitherto unknown as a fossil. More recently, Parker (1929), after an examination of the same material, has questioned my interpretation of the fossil, which, it should be emphasized, consists only of an impression with some bone fragments adhering. He considers the species the type of a new genus, *Lithobatrachus*, which he does not definitely assign to any family but assumes to be most closely related to the Pipidæ and Palæobatrachidæ. To include it in either of these families would mean a considerable revision of the definition of the group. Most of the characters which Parker employs in defining *Lithobratrachus* are shown in my photograph of the fossil (Noble, 1928, Fig. 5) and were considered at the time my description of the species was made. There are several reasons why Parker's interpretation cannot be accepted, and these may be considered, following the order of his description.

Many fossorial Salientia, such as *Kaloula* and various other brevicipitids, have a strongly ossified occiput with the occipital condyles lying entirely or for the greater part posterior to a line drawn between the posterior ends of the jaws (articulars). This is also true of narrow-headed aquatic types, such as *Xenopus tropicalis*, which swim swiftly through the water. On the other hand, broad-headed terrestrial forms, such as *Hyla* or *Rana*, and even aquatic species with a broad-head, such as *Pipa pipa*, have the greater part of the condyles lying anterior to the same line. The fossil specimen under discussion is unquestionably a broad-headed form (Noble, 1928, Fig. 5), and hence we may feel sure that the occipital condyles lay on the same level of the anterior-posterior axis as the mesial ends of the clavicles in the fossil. This being true, there is no possibility that the slight elevation described by Parker as the first vertebra is really the impression of that structure, unless the vertebral column was disarticulated from the condyles and drawn posteriorly before fossilization. There is no evidence in the fossil that such a disarticulation occurred, and Parker interprets the first vertebra as making an articulation with the condyles. The slight impression which Parker compares to the first vertebra of *Xenopus* and *Pipa* lies on the same plane as the coracoid and resembles closely a piece which I considered a part of the procoracoid cast. This anterior piece has no connection with the skull and cannot have been made by a part of the exoccipitals as Parker suggests. The posterior imprint does not agree in detail with the first vertebra of either *Pipa pipa* or *Xenopus tropicalis*. Nor does it agree in detail with other possible structures such as the larynx or hyoid. The faint imprints which seem to be associated with the posterior impression are directed posteriorly like thyroid processes of the hyoid and not laterally like transverse processes of a vertebra. In brief, the imprints in question show no diagnostic characters, but the evidence is decidedly against these having been made by a first vertebra.

Parker figures the scapula of the fossil as terminating considerably short of the clavicle on both sides. There is no doubt that a depression occurs in the fossil at the point Parker assumes to be the proximal end of the scapula. The depression was apparently formed by a preglenoid process similar to that found in many Salientia. There is, however, a slight depression between this point and the clavicle. I assumed it to have been made by an ossified or calcified acromion such as occurs in the great majority of Salientia. On the left side of the fossil the anterior margin of the scapula can be traced until it meets the clavicle. There is no doubt that the left scapula at least was longer than Parker has figured it. This is of interest, for it definitely excludes the species from the Discoglossidæ, Pipidæ, and probably from the Palæobatrachidæ.

The Hylidæ are distinguished from the Bufonidæ primarily by the presence of an intercalary cartilage or bone between the last two phalanges of each digit. In describing the fossil, considerable attention was given to the digits. Unfortunately only one digit is clearly indicated and that only by an impression. It would not appear from Parker's figure of this imprint (Parker 1929, fig. 2*a*) that the terminal phalanx must have been actually curved and that its tip dug into the substratum. In ordinary museum skeletons of Hylidæ, the intercalary is difficult to see from the ventral surface because the proximal end of the terminal phalanx, being free to slide back over the intercalary, is drawn proximally on drying and covers the greater part of that element. I have examined hylids which have died and decomposed on a flat surface while being shipped to me from the tropics, and noted that in most of these cases the intercalaries were not covered but plainly visible from the ventral surface. The segment between the two last phalanges of the fossil specimen is too thick to be a syndesmosis. The impression is not a perfect one, but it agrees well in shape with the terminal phalanges of the several species of *Hyla* available to me in skeleton form.

Parker considers several other features in the fossil to support his view that its affinities are with the Pipidæ and Palæobatrachidæ. The impression of the skull is very poor, and there is no way of determining the limits of pterygoids, palatines, ascending processes of the maxillæ, or any other structures which might be present on a crushed palate. Hence, the comparison of this palate with that of *Xenopus* rests on a very unsound basis. Parker compares the clavicles with those of *Xenopus.* The coracoids and scapulas, which are better indicated, have no resemblance to those of *X. lævis* and *X. tropicalis.* Further, the element which Parker considers the dilated end of the clavicle differs in texture from the adjacent bone, and it may have been a replacement or cast of the procoracoid cartilage. Lastly, Parker believes there is evidence that the fossil possessed ossified pubes. The imprint on the right side of the ischial symphysis is in direct continuation with the femur and has the appearance of being an impression of a fractured piece of the calcified head of the femur. The imprint of the alleged left pubis was made by a fractured piece either of the ilium or of the pubo-ischium. Many Salientia in various families have calcified pubes, and these are firmly joined to the ischium. As shown in Parker's figure 1, the two imprints are of very unequal size, and the possibility of their having been formed by paired free pubes seems excluded.

In brief, the result of Parker's analysis is to bring out more clearly the difficulty of interpreting a fossil based for the greater part on an impression alone. The species shows no affinities to the Pipidæ. Its procœlous vertebræ, its free coccyx with two condyles, and its long scapula, exclude it from the family, and none of the similarities mentioned by Parker rests on a sound basis. Its supposed affinity to the Palæobatrachidæ is based chiefly on the assumption that the sacrum was double. There is no proof of this assumption. On the other hand, the greatly dilated sacral diapophyses and relatively short metacarpals exclude it from the genus *Palæobatrachus,* the only valid genus in the family. Since the fossil agrees with *Hyla* in all diagnostic characters, I have referred it to that genus. Until additional specimens of the species are discovered, *Lithobatrachus* should be referred to the synonymy of *Hyla.*

CONCLUSIONS

Oxyglossus pusillus (Owen) of the Eocene of India is a toothed bufonid (leptodactylid) closely related to *Crinia* and its allies of Australia. A new genus, *Indobatrachus*, is erected for the species. The discovery of a toothed bufonid in the Eocene of India lends support to the theory of a northern origin for the Australian frog fauna.

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List of Abbreviations

Cen. = Centrum.
Cl. = Clavicle.
Coc. = Coccyx
Con. = Condyles of coccyx
Cor. = Coracoid.
Eth. = Ethmoid.
Fr. Par. = Fronto-parietal.
Hu. = Humerus.
Il. = Ilium.
In. Ver. = Intervertebral elements (i.e., the split interdorsal and interventral).
Md. = Mandible.
Mx. = Maxilla.
Na. = Nasal.
Pal.? = Palatine?
Pr. = Prootic.
Pr. Mx. = Premaxilla.
Pt. = Pterygoid.
S. Di. = Sacral diapophysis.
S. Sc. = Suprascapula.
Sc. = Scapula.
Sq. = Squamosal.
Vo. = Vomerine teeth.
Vo. R.? = Dorsal aspect of vomerine tooth patch?
Zy. = Zygapophysis.

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SOME CHINESE FRESH-WATER FISHES[1]

BY J. T. NICHOLS[2]

XXII.—*APHYOCYPRIS*, DESCRIBING A RACE FROM SHANTUNG

A series of the minnow, *Aphyocypris*, obtained at Tsinan, Shantung, in the summer of 1924, by a native collector under the direction of Mr. Clifford H. Pope, show certain differences from *A. chinensis* (a specimen of which has been examined from southern Hupeh) and seem to be a chubby deeper-bodied fish.

Aphyocypris chinensis shantung, new subspecies

DESCRIPTION OF TYPE.—No. 9671, American Museum of Natural History, from Tsinan, Shantung, summer of 1924.

Length to base of caudal, 46 mm. Depth in this length, 3.3; head, 3.5. Eye in head, 3.6; snout, 3.5; interorbital, 2.4; maxillary, 2.6; depth of peduncle, 2; its length, 1.4; width of body, 1.5; pectoral, 1.3; ventral, 1.8; longest dorsal ray, 1.5; anal ray, 1.7; lower caudal lobe, 1.3.

Dorsal rays, 9; anal, 9. Scales, 32, the lateral line on the four anterior only.

Head rather broad and blunt, the interorbital flattish, body not much compressed and belly gibbous, with a sharp, naked keel behind the ventrals. Mouth moderately oblique, maxillary to under front of eye, jaws equal or the lower very slightly projecting, no barbels. Gill-membranes joining one another and isthmus under posterior margin of eye, little, if at all, free. Dorsal and anal with soft rays only; dorsal origin equidistant from edge of preopercle and base of caudal, well behind ventral axil, the anal origin a little behind dorsal axil. Pectoral not quite reaching ventral, and

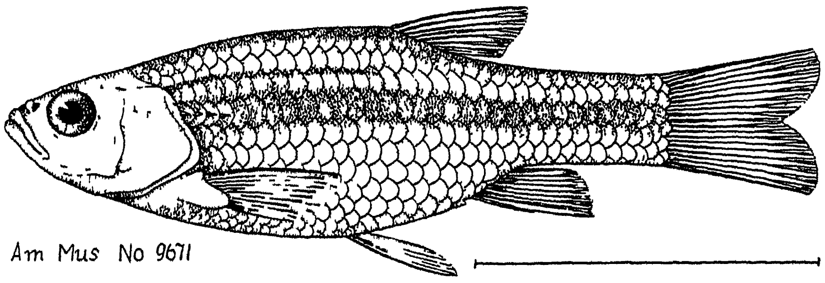

Fig. 1. *Aphyocypris chinensis shantung*, type.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 97.

[2] Drawings of the type specimens by Mrs. Helen Ziska.

ventral not reaching anal; caudal weakly forked, the lower lobe the longer. Scales with strong concentric and poorly marked radiating striæ, other fine parallel markings sometimes discernible.

Brownish above, paler below, a dark stripe along the midline of the back, and dark lateral band from eye to caudal, best marked posteriorly, about as broad as eye at the broadest.

Measurement of several other specimens, to show variation, are given in the following table.

Standard Length	Depth	Head	Eye	Dorsal	Anal	Scales
30 mm.	3.7	3.6	3.2	8		30
33	3.8	3.4	3.5	9	10	32
34	3.6	3.8	3.2	9	9	33
34	3.7	3.6	3.4	9	9	31
34	3.3	3.6	3.4	8	9	31
35	3.2	3.5	3.4	9	9	30
41	3.4	3.7	3.6	9	9	31
41	3.5	3.6	3.6	9	9	33
43	3.4	3.6	3.6	9	9	31

All of these have the lower jaw more or less appreciably projecting.

In the series to hand, which comprises 44 specimens, 2 are aberrant and may represent a distinct species, which it seems best not to describe without further similar material, or further material of what has been called *A. kikuchii* from Fukien (1928, Bull. Amer. Mus. Nat. Hist., LVIII, p. 25). They have only a slight posterior streak in place of the dark lengthwise band characteristic of *A. c. shantung*, lower jaw appreciably projecting, measurements (as in the above table) as follows:

29 mm.	3.1	3.5	3.5	9	9	29
30	3.1	3.5	3.4	9	9	30

Species and races of *Aphyocypris* in China may now be differentiated as follows:

1. Lateral line complete; scales 35; depth 4 (at 64 mm. standard length); jaws equal...*normalis*.
   Lateral line incomplete; scales 30 to 33..2.
2. Depth 4 (at 30 to 50 mm. length); scales 32; lower jaw scarcely projecting. *chinensis*.
   Depth 3.2 to 3.8 (at 30 to 45 mm. length); scales 30 to 33; lower jaw slightly projecting; dorsal origin equidistant between edge of preopercle and base of caudal; a pronounced dark lateral band......................*shantung*.
   Depth 3.5 (at 60 mm. length); scales 30; lower jaw distinctly projecting; dorsal origin equidistant between front of eye and base of caudal......*kikuchii*.

XXIII.—GOBIES REFERABLE TO THE GENUS *MICROPERCOPS*

Some specimens of a small eleotrin goby from Shantung are very close to *Micropercops dabryi* (type of *Micropercops*) Fowler and Bean (1920, Proc. U. S. Nat. Mus., LVIII, p. 319, Fig. 2.) from Soochow, type only, and also close to the fish identified with *Eleotris swinhonis* Günther (Nichols, 1928, Bull. Amer. Mus. Nat. Hist., LVIII p. 54, Fig. 47), Yangtze Valley. Whereas *Micropercops* is described as having the sides of the head without scales, these specimens to hand have the opercle distinctly scaled and traces of scales visible on the preopercle, a character which is readily appreciable in specimens of 40 mm. or more, standard length, and was very likely overlooked in the single small specimen examined by Fowler and Bean. It is obviously correct to separate these little gobies from *Eleotris*. They are very variable, but probably distinct from *Micropercops dabryi*, though the most trenchant difference, fewer scales, is somewhat vitiated by the irregularity and crowding of the scales anteriorly, allowing of some latitude in the count. The following name is proposed for them.

Micropercops dabryi borealis, new subspecies

Description of Type.—No. 9672, American Museum of Natural History, from Tsinan, Shantung, summer of 1924, a native collector under the direction of Clifford H. Pope.

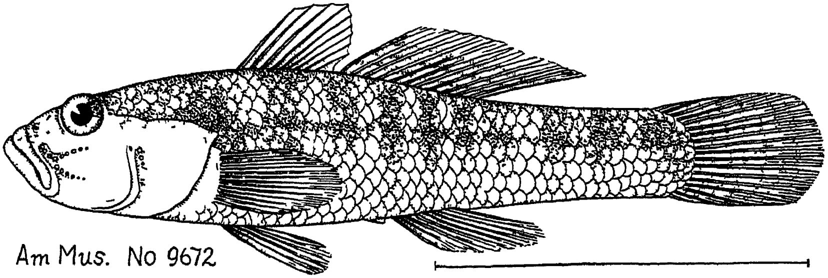

Fig. 2. *Mycropercops dabryi borealis*, type.

Length to base of caudal, 44 mm. Depth in this length, 4.4; head, 3.4. Eye in head, 4.5; snout, 3.5; interorbital, 4.5; maxillary, 3; greatest width of body (at the back of head), 1.6; length of peduncle (from dorsal axil), 1.3; its depth, 2.4; pectoral, 1.5; ventral, 1.9; longest dorsal spine, 2.5; longest dorsal ray, 2.1; longest anal ray, 2.3; caudal, 1.5.

Dorsal, IX–12; anal, 10. Scales, 37. Teeth in bands in jaws.

Body moderately compressed; nape not elevated. Lower jaw projecting; maxillary oblique, to under front margin of eye; interorbital slightly concave; gill-membranes separate, gill-cleft to under middle of eye; opercle and preopercle unarmed; various rows of pores on head. Ventrals separated by a distance about equal to the base of each; dorsals narrowly separated, the posterior rays of the spinous dorsal when depressed overlapping the origin of the second dorsal; anal origin slightly behind, its axil slightly before that of second dorsal; caudal rounded. Scales ctenoid, irregular and somewhat crowded at the shoulder; just appreciable on preopercle, more distinct on opercle and nape, absent on interorbital snout and jaws.

Color somewhat darker above than below; a faint dark mark downward and slightly forward below the eye; sides with light and dark cross-bands, varying in width, spacing and intensity, the dark bands tending to be the broader. On the right side there are about 4 broad dark double bands split by relatively indistinct pale central stripes or streaks; on the left side about 8 dark bands are separated by somewhat narrower pale ones. Fins grayish; the second dorsal and caudal faintly barred, and the first dorsal dusky.

Comparative measurements of a few more specimens give an idea of the range of variation.

Standard Length	Depth	Head	Eye	Dorsal	Anal	Scales
32 mm.	3.8	3.4	4	VIII–11	9	33
33	4.2	3.4	4	IX–11	9	33
35	4	3.3	3.9	IX–11	9	34
39	4.1	3.5	3.7	VIII–12	9	35
40	4	3.5	4.5	VIII–12	9	34
40	3.9	3.4	4.6	IX–12	9	34
42	4.2	3.4	4.4	IX–11	9	35
48	3.6	3.6	4	IX–11	10	34

The two specimens of 40 mm. have the cross-bands restricted, suggesting the color-pattern figured for *M. dabryi* by Fowler and Bean. On the other hand, in the total series of some 100, I have found one otherwise aberrant specimen (of 43 mm.) with color-pattern more as figured for *M. swinhonis* by Nichols. It can not be matched or even satisfactorily linked to the others, although another specimen (of 41 mm.) seems somewhat intermediate. Same measurements as above for these two follow.

43 mm.	4	3.4	4.4	VII–12	10	31
41	4	3.4	3.8	VIII–11	9	31

It is quite likely that *dabryi* and *borealis* are only racially distinct from *swinhonis*, but we may with equal right assume that *swinhonis* (the 43 mm. specimen) occurs occasionally in the range of *borealis*. There is nothing unusual in finding forms in North and South China more closely related to one another than to their representative in the Yangtze Valley.

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NEW SPECIES OF DIPTERA BELONGING TO THE GENUS *BACCHA* FABRICIUS (SYRPHIDÆ)

BY C. H. CURRAN

I have vainly attempted to find some character by which to separate *Ocyptamus* from *Baccha*. In typical species of *Ocyptamus* the abdomen has parallel sides and large third antennal segment and in the females the second antennal segment projects, on the inner side, triangularly into the third: this applies to a lesser degree in the males of some species. The two groups have so many forms connecting them, regardless of the character used, that the only justifiable course is to consider all the species as belonging to one genus.

In the preparation of the key I have included only those species of which I have representatives, and almost half of the described species are omitted. The number of species is quite large, as might be expected, since this genus replaces *Syrphus* and *Epistrophe* in the American tropics. The larvæ are beneficial and feed upon aphids, mealy bugs, and probably scale-insects. The pupæ are of peculiar shape, being suddenly flattened behind the middle and remarkably short when one considers the length of the adult insect.

In order to clear up some of the confusion existing in regard to several of the species described by older authors, I present records of new and recent synonymy.

BACCHA Fabricius

FABRICIUS, 1805, 'Syst. Antl.,' p. 199.
Ocyptamus MACQUART, 1834, 'Hist. Nat. Dipt.,' I, p. 554.

TABLE OF SPECIES

1. Face black or with a median black or brown vitta at least above or below the tubercle.......................................32.
   Face yellowish or reddish, the oral margin rarely blackish..................2.
2. Third antennal segment much longer than the first or second..............3.
   All the antennal segments of nearly equal length................*atypica*, n. sp.
3. Scutellum wholly black or brown.......................................4.
   Scutellum partly or wholly reddish or yellow.............................5.
4. Abdomen in part steel-blue (West Indies)...............*cylindrica* Fabricius.
   Abdomen partly bronzed, never steel-blue...............*fuscipennis* Say.

5. Wings with a disconnected small apical brown spot . . . . .6.
Wings without disconnected apical spot . . . . .7.
6. Disc of scutellum shining black. . . . . *exigua* Williston.
Scutellum wholly pale . . . . *lineata* Macquart.
7. Scutellum with definite black or brown markings. . . . . .8.
Scutellum yellowish or reddish, the discal markings never black or brown, although often darker than the margins. . . . . 11.
8. Base of scutellum narrowly stramineus. . . . . .9.
Base of scutellum blackish . . . . .10.
9. Costal border strongly brown, sharply contrasting with the hyaline posterior part . . . .*dolosa* Williston.
Wings pale brown, paler basally. . . . .*bromleyi* Curran.
10. Wings with a large median brown triangle or uniformly grayish, the base always brown . . . .*gastrostactus* Wiedemann.
Wings rich brown on basal half or more or pure hyaline sub-basally. . . . . . . .11.
11. Wings hyaline with a brown fascia or triangle at the middle. . . . . .12.
Wings differently colored. . . . . 13.
12. Anterior cross-vein situated at basal fifth of discal cell. *lemur* Osten Sacken.
Anterior cross-vein beyond basal third of discal cell. . . .*fascipennis* Wiedemann.
13. Sides of mesonotum broadly yellow or reddish. . . . . .15.
At most the humeri, notopleura, and posterior calli yellowish or reddish. . . . .14.
14. Second abdominal segment wider than long. . . . .*scutellatus* Loew.
Second abdominal segment almost twice as long as wide. . . .*funebris* Macquart.
15. Pleura yellowish on its whole length. . . . . .16.
Pleura blackish or at least with an entire black fascia which is not interrupted by the posterior spiracle. . . . . .23.
16. Ventral scutellar fringe yellow and composed of abundant long, fine hair. *persimilis* Williston.
Ventral fringe black, usually very short . . . . .17.
17. Mesonotum ochreous, usually with shining black vittæ. . . . . .18.
Mesonotum shining blackish with two metallic reddish vittæ. .*croacea* Austen.
18. Second abdominal segment very much longer than wide. . . . . .19.
Second abdominal segment not longer than wide, very strongly narrowed on basal half. . . . .*flavipennis* Wiedemann.
19. Sternum wholly yellowish or reddish. . . . . .21.
Sternum black. . . . . .20.
20. Abdominal segments with three black vittæ. . . . . .species, Brazil.
Abdominal segments with four black vittæ. . . . .*notata* Loew.
21. Median black mesonotal vittæ wider than the intervening pale vitta. . . . . .22.
Median black mesonotal vittæ narrower than the intervening pale vitta. *livida* Schiner.
22. Yellow markings on third and fourth abdominal segments in form of inverted V. *placiva* Williston.
Yellow markings forming more or less continuous vittæ. . . .*phæoptera* Schiner.
23. Second abdominal segment not twice as long as wide. . . . . .24.
Second abdominal segment at least twice as long as wide. . . . . .27.
24. Abdomen strongly narrowed basally, at least widest on apical half. . . . . .26.
Abdomen broad, not spatulate. . . . . .25.

25. Third abdominal segment with an anteriorly broadened median black vitta cutting across the yellow band........ ... *lepida* Macquart.
    Third segment with a very obscure line of black connecting the two black fasciæ. *cultrata* Austen.
26. The lateral black markings on the third abdominal segment strongly converge anteriorly........ *pumilla* Austen.
    The lateral black markings form basal triangles at the sides of the segment. *crocata* Austen.
27. Wings with brown tinge at least in front........ 28.
    Wings hyaline with brown stigmal cell........ 57.
28. Apical segments of posterior tarsi yellow........ 29.
    Apical segments of posterior tarsi brownish........ *mentor*, n. sp.
29. Hind tibiæ wholly yellowish........ 30.
    Hind tibiæ broadly brown apically........ 31.
30. Second abdominal segment with interrupted yellow fascia...... *vierecki*, n. sp.
    Second abdominal segment with entire yellow fascia behind the middle. *crocata* Austen.
31. Costal border brownish on at least basal half........ 58.
    Wings almost uniformly colored, slightly darker on apical part.. *prenes*, n. sp.
32. Face with a conspicuous tubercle........ 36.
    Face with a scarcely perceptible tubercle........ 33.
33. Cross-veins bordered with brown........ 34.
    Cross-veins not bordered with brown........ 59.
34. Mesonotum shining black........ 35.
    Mesonotum reddish with brown median vitta in front.. *rubida* Williston.
35. Second abdominal segment reddish........ *bigoti* Austen.
    Second abdominal segment black........ *incompta* Austen.
36. Abdomen not at all constricted on second segment and always shorter than the wings........ 37.
    Abdomen constricted basally or longer than the wings........ 38.
37. Wings uniformly colored on whole length in front........ *latiusculus* Loew.
    Wings paler on apical third or more........ *dimidiatus* Fabricius.
38. Oral margin more prominent than the tubercle........ *clavatus* Fabricius.
    Oral margin not as prominent as the tubercle........ 39.
39. Sixth abdominal segment of female not longer than fourth........ 41.
    Sixth abdominal segment much longer than fourth segment and cylindrical.. 40.
40. Wings hyaline on apical half........ *telescopica*, n. sp.
    Wings hyaline on apical fourth........ *peruviana* Shannon.
41. Legs entirely black........ 42.
    Legs partly yellow........ 43.
42. Apical cross-vein very little curved........ *signifera* Austen.
    Apical cross-vein conspicuously bisinuate (*punctata* Shannon?) *adspersa* Fabricius.
43. Wings hyaline with a transverse median triangle and the base brown. *lemur* Osten Sacken.
    Wings differently marked........ 44.
44. Anterior four femora black or brown, the apex narrowly pale........ 45.
    Anterior four femora mostly reddish or yellow........ 50.

45. Posterior femora and tibiæ with short, appressed pile........ .....46.

Posterior femora and tibiæ with abundant, long suberect pile..*pilipes* Schiner.

46. Scutellum with whitish pile ....47.

Scutellum black-haired dorsally.......................48.

47. Occipital cilia white; fifth abdominal segment with white hair. *shropshirei*, n. sp.

Occipital cilia black; fifth abdominal segment with black hair...*zeteki*, n. sp.

48. Face yellow laterally.............................49.

Face wholly steel-blue ....*panamensis*, n. sp.

49. Pteropleura black-haired......................*nitidula*, n. sp.

Pteropleura with pale pile ....*clarapex* Wiedemann.

50. Stigmal cell uniformly brownish or luteous......................51.

Stigmal cell with a deep brown basal spot, pale apically........*cognata* Loew.

51. Sides of mesonotum yellowish in front of the suture ....52.

Sides of mesonotum not yellowish between humeri and notopleura.........54.

52. Disc of scutellum blackish ....53.

Scutellum wholly yellowish.....................*stenogaster* Williston.

53. Yellow side margins of the mesonotum broadly interrupted behind the suture. *carlota* Curran.

Yellow side margins entire......................*ornatipes* Curran.

54. Wings extensively brown...............................55.

Only the stigmal cell brown......................*deceptor*, n. sp.

55. Scutellum wholly blue-black..........................*costata* Say.

Scutellum brownish red, darker basally...........................56.

56. Abdomen with parallel sides ....*funebris* Macquart.

Abdomen narrowed basally (*lugubris* Williston).........*mexicana*, n. name.

57. A black spot above the antennæ.........................*chapadensis*, n. sp.

No black spot above the antennæ............................*macer*, n. sp.

58. The brown costal border is evanescent apically................*murina*, n. sp.

The brown costal border extends to the apex of the wing...*punctifrons* Williston.

59. The black of the third and fourth abdominal segments is bisected for most of its length by a very broad reddish vitta..................*gowdeyi* Curran.

The black is not bisected by a pale vitta................*gracilis* Williston.

Baccha telescopica, new species

Related to *peruviana* Shannon but at once distinguished by having the wings hyaline on the apical half. The apical two abdominal segments are greatly elongate and polished black, being almost as long as the remainder of the abdomen. Length, 12.5 to 15.5 mm.

FEMALE.—Head steel-blue; occiput, face, except the large tubercle and a narrow orbital triangle below the middle of the front, whitish pollinose. Front opaque brown from the ocelli to the middle but with dull black vitta dividing the brown color on its anterior half; antennal tubercle black above. Pile black; on the lower two-thirds of the occiput pale yellowish. Antennæ brownish red, the third segment and arista brownish, the third segment hardly twice as long as wide.

Mesonotum and scutellum shining black, thinly brown pollinose, clothed with moderately short, sparse black hair, the scutellum with black ventral fringe; no collar of hair on the front of the mesonotum. Pleura and sides of the mesonotum in front of the suture steel-blue, white pollinose and pilose.

Legs brown; apices of femora and broad bases of the tibiæ reddish yellow; posterior tarsi yellow with the apical segment wholly and the basal three-fourths of the first segment brown. Anterior tarsi slightly broadened and flattened.

Wings with the basal half and stigma brown, the apical half cinereous hyaline. Squamæ and halteres yellow, the former with brownish yellow fringe.

Abdomen with the intermediate segments brownish red; basal segment steel-blue with the broad apex brownish red; fifth and sixth segments shining black, the sixth without hair and forming a cylindrical tube. Second, third, and fourth segments broadly orange basally except in the middle, the pale color not sharply limited nor regular in outline. Pile black; white on the sides of the first segment and on the first sternite.

TYPES.—Holotype, female, Barro Colorado Island, Canal Zone, December 22, 1928. Paratype, female, Barro Colorado Island, December 27, 1928, (Curran).

Shannon described both sexes of *peruviana* erecting a new subgenus, *Pelecinobaccha*, for the species. *B. peruviana* has the sides of the face yellowish. The male of *B. telescopica* may be separated from the species described by Shannon and also those related to *dimidiatus* Fabricius by the wholly black face.

It seems likely that this species will be found to have an interesting life history. The elongate ovipositor might suggest that the larvæ are predacious upon coccids or aphids which live on the roots of plants. The specimens were both taken in the banana plantation to the left of Shannon's Cove, looking toward the canal from the Barro Colorado Laboratory.

Baccha latiusculus Loew

Ocyptamus latiusculus LOEW, 1866, Berl. Ent. Zeitschr., X, p. 39.
?*Ocyptamus proximus* SCHINER, 1868, 'Novara Reise,' Dipt., p. 346.
?*Ocyptamus infuscatus* BIGOT, 1884, Ann. Soc. Ent. France, p. 324.

Without an examination of the types it is not possible to state definitely that these names represent a single species but, from the descriptions, it seems probable that such is the case.

Baccha gastrostactus Wiedemann

Syrphus gastrostactus WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 123.
Syrphus trigonus WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 126.
Pipiza costalis WALKER, 1837, Trans. Linn. Soc. London, XVII, p. 342.
Pipiza pica WALKER, 1857, Trans. Ent. Soc. London, IV, p. 156.
Baccha torva WILLISTON, 1886, 'Synopsis N. Amer. Syrphidæ,' p. 124.

The two sexes of this species are quite different in appearance, the males lacking the triangular brown costal spot on the middle of the wing, which is usually present in the females, the females normally lacking the striking yellow spots on the abdomen.

Baccha mexicana, new name

Baccha lugubris WILLISTON, 1891, 'Biol. Centr. Amer.,' Dipt., III, p. 37, (nec Philippi, 1865).

Philippi used the name *lugubris* for a species from Chile. Since I have no record of the name having been changed and the types of Williston's species are before me I propose the above name.

Baccha costata Say

SAY, 1829, Journ. Acad. Sci., Phila., VI, p. 61.
Baccha costalis WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 97.
Baccha tarchetius WALKER, 1849, 'List. Dipt. Brit. Mus.,' III, p. 549.

I have previously indicated the synonymy of *tarchetius* and *costalis*. There can be no doubt that both these names apply to the same species as that which Say described.

Baccha vierecki, new species

Allied to *crocata* Austen but with the second abdominal segment more elongate and bearing an interrupted reddish-yellow fascia. Length, 9 to 10.25 mm.

MALE.—Head yellow; occiput black, cinereous pollinose; vertical triangle black, dull, yellowish brown pollinose behind the ocelli; a small shining black spot on the lunula. Frontal triangle dull above, somewhat shining on anterior two-thirds, brown pilose. Pile of face and occiput pale yellow; on the vertical triangle and upper fourth of occiput black. Cheeks linear; face receding, the tubercle large and long. Antennæ pale orange, the arista black.

Mesonotum brownish black, somewhat shining, brown pollinose, the sides very broadly yellow, the black color divided into three nearly equal parts by a pair of incomplete reddish vittæ; pile sparse, yellowish, becoming brown behind and on the scutellum. Pleura yellow, a broad band of brown covering the metanotum, hypopleura, and metapleura. Scutellum yellow, the hair sparse and fairly long; no ventral fringe. No collar of hair on the front of the mesonotum.

Legs yellow, the posterior femora with a broad, preapical black band. Hair wholly yellowish.

Wings yellowish, the costal border brown on its whole length; alula very narrow.

Abdomen pale orange with blackish markings. First segment yellow, broadly black posteriorly except at the sides. Second segment blackish with a pair of oblique narrowly separated pale orange spots which are widest anteriorly, extend to a little in front of the middle of the segment and are broadly separated from the posterior border, the lateral margins of the segment broadly reddish in front of the pale spots. Third segment pale orange, the posterior third, a narrow median vitta and lateral basal triangles blackish. Fourth segment with a median vitta, subtriangular lateral spots on the apical corners and basal triangles on the sides, blackish; fifth segment black with a pair of very broad dorsal yellow vittæ. On the fourth and fifth segments the black margins form three vittæ: the median one narrowest and entire; the outer ones produced triangularly forward interiorly and reaching almost to the basal third of the fourth segment. The sides of the third and fourth segments are brownish. Abdominal pile all black. Genitalia brown above and apically, reddish below.

FEMALE.—Front very narrow above, yellow in front of the ocellar triangle and with a rather narrow median brown or black vitta extending almost to the lunula; frontal pile black or brown. The fifth abdominal segment bears a yellow triangle on the anterior corners and the median black vitta tapers slightly to the posterior border and may or may not be continued over the sixth segment; sides of sixth segment broadly brown.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, February 13, 1929. Allotype, female, December 22, 1928. Paratypes: one male and four females, Barro Colorado Island, December 22, 23 and 27, 1928, January 7, 1929, February 13, 1929, (Curran); one female, Vista Nieve, Santa Marta, Colombia, December 16, (H. L. Viereck).

Baccha shropshirei, new species

A small black species, the legs and antennæ partly pale; fifth segment with conspicuous, appressed whitish pile. Length, about 8.5 mm.

FEMALE.—Head black, the sides of the face obscurely brownish red; occiput cinereous pollinose; face with more whitish pollen. Front steel-blue in front of the ocellar triangle, the sides very broadly cinereous-white pollinose, leaving a bare vitta which widens slightly anteriorly. Pile of head whitish except the single, obscure row of hairs extending from the ocellar triangle to the vertex. Face receding below the tubercle which is moderately large and has the apex free of pollen. Antennæ brown, the third segment orange below, about one-half longer than wide.

Mesonotum brownish black, the broad lateral margins, a slender median vitta which is abbreviated behind and a broad vitta toward either side cinereous pollinose on steel-blue ground. The broad vittæ diverge posteriorly and reach the inner ends of the posterior calli. Pleura and scutellum steel-blue and cinereous pollinose. Pile of thorax wholly cinereous white; no collar of hair on the front of the mesonotum; scutellar fringe long.

Legs black; apices of femora and basal third of the tibiæ reddish yellow. Anterior tarsi a little broadened and flattened. Hair wholly black except on the coxæ.

Wings brown on basal half, the marginal cell paler basally, apical half cinereous hyaline. Squamæ and halteres pale yellow. Alula large.

Abdomen steel-bluish, with opaque black markings; first segment opaque except laterally; second with a large opaque black triangle broadly separated from the posterior border of the segment and less narrowly from the lateral margins. Third segment with an opaque black triangle of the same general shape as that on the second segment. Fourth segment with a broad, incomplete median opaque vitta and a large, opaque black subtriangular spot on either side, the fifth with a median vitta on the basal two-thirds and an elongate oval, oblique spot extending from the base to the apical corners; sixth segment shining black. Pile cinereous white on the blue areas, shorter and black on the opaque areas, erect only on the sides of the first segment. The abdomen is strongly spatulate, narrowest near the base of the second segment and strongly increasing in width to the apex of the fourth.

HOLOTYPE.—Female, Corozal, Canal Zone, January 16, 1929, (Curran).

Named for Mr. J. B. Shropshire of the Army Sanitary Division, in recognition of his hearty coöperation during my collecting trip to the Canal Zone.

Baccha zeteki, new species

A small black species with very strongly spatulate abdomen, the antennæ and legs partly reddish yellow. Length, 7 to 7.5 mm.

MALE.—Head black, a subtriangular spot of steel-blue on either side of the frontal triangle. Face and occiput cinereous-white pollinose, the moderately large tubercle with its tip bare; blue frontal spots overlaid with silvery-white pollen; front broadly opaque black in the middle, the antennal prominence shining. Pile yellowish white, black on the frontal triangle, vertical triangle and upper fourth of the occiput. Antennæ brown, the third segment yellowish below.

Mesonotum subopaque blackish, the sides shining, the disc with brownish tinge in some lights, the pile brown, not conspicuous. Pleura bluish black, thinly cinereous pollinose, the pile whitish. Scutellum shining, thinly cinereous pollinose, finely whitish haired, the ventral fringe sparse.

Legs brown; apices of the femora, broad bases of the tibiæ and the intermediate segments of the posterior tarsi, reddish yellow, the apex of the first segment of the posterior tarsi only narrowly reddish; basal half of posterior femora often brownish red.

Wings strongly tinged with brown, the stigma brown. Alula large. Squamæ brown. Halteres yellow.

Abdomen shining black, the first segment and basal half of the second rather bluish; second segment with two broad, opaque black bands, the three shining bands of almost equal width; third segment with a very broad, anteriorly convex opaque black band which does not reach the lateral margins and is very widely separated from the posterior margin; fourth and fifth segments with broad, indefinite opaque fasciæ. Pile black; white on the first segment, sides of the second and basal angles of the third and fourth.

FEMALE.—Lower half of front shining bluish except a broad median vitta, the blue color overlaid with thin silvery-white pollen; pile black. Mesonotum toward either side with a more or less distinct white pollinose vitta in front of the suture. Posterior femora often yellow on basal half. Wings brown on almost the basal half, cinereous hyaline apically. Squamæ whitish. Opaque areas on fourth and fifth segments usually more or less divided in the middle.

The abdomen is very strongly spatulate, the second segment cylindrical, of almost equal width throughout, the third segment strongly widening posteriorly and almost as wide as the fourth.

TYPES.—Three males and eight females, Barro Colorado Island, Canal Zone, December 22, 1928, Jan. 8, 10 and 28, 1929, (Curran), and one female, Chapada, Brazil, (Williston Collection). The holotype male and allotype female were taken on January 28, 1929.

Named in honor of Mr. James Zetek, resident entomologist of the Bureau of Entomology and a tireless worker in the interests of the Institution for Research in Tropical America.

Baccha panamensis, new species

Very similar to *zeteki*, new species, but the scutellum is black-haired in the male, partly so in the female, and with very thin brownish instead of cinereous pollen; wings brownish, more grayish apically and posteriorly. Length, 8 to 9 mm.

MALE.—Head black, the face and sides of the front bluish, shining cinereous-white pollinose; middle of frontal triangle opaque black, the antennal prominence shining black. Occiput whitish pollinose and pilose on lower three-fourths, black pilose above; vertical triangle small, blue-black, black-haired. Pile of face black. Antennæ brown, brownish red below.

Mesonotum opaque or subopaque blackish, in some lights with a median brownish vitta in front, in other lights with two brownish triangles anteriorly; pile black. Pleura bluish black, pale yellowish pilose. Scutellum shining black, with very thin brown pollen and sparse ventral fringe.

Legs black, tips of the femora and narrow bases of the tibiæ reddish; second and third segments of the posterior tarsi yellow. Hair black except on the yellow tarsal segments.

Wings brown, the apical third brownish gray, the colors diffuse; alula large. Squamæ white; halteres yellow.

Abdomen shining black. Second segment with a broad, subtriangular band of opaque black behind the middle, which reaches the lateral margins and is more or less produced forward dorsally; third segment with an opaque black, subtriangular spot covering most of the disc but leaving the borders of the segment broadly shining. Fourth segment with the disc obscurely subopaque, the fifth with no opaque areas. Pile black, whitish on the immediate sides of the first segment. Abdomen strongly spatulate, the second segment slightly widening from near its base to the apex, the third strongly widening from base to apex.

FEMALE.—Front shining black, below the middle with a large, subtriangular bluish, white pollinose spot on either side, the pile wholly black. Face with cinereous pile. Hair of scutellum mixed black and whitish. The darker brown color is confined to the basal half of the wing. Posterior femora brownish red on basal half.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, December 23, 1928. Allotype, female, December 22, 1928. Paratypes: male, Barro Colorado Island, January 3, 1929, (Curran); male, Ancon, Canal Zone, February 2, 1916, (T. Hallinan).

Baccha nitidula, new species

Black; wings black with the apical fourth or less grayish. Related to *clarapex* Wiedemann but the mesonotum lacks pale pile in front and the pteropleura is black pilose. Length, 8 to 11 mm.

MALE.—Face and sides of front bluish, the former cinereous-white pollinose, its sides broadly yellow in the middle. Frontal triangle shining black, its upper half covered with black pollen, the bluish sides thinly white pollinose. Vertical triangle small, bluish, black-haired. Pile of the frontal triangle, sides of the face and upper fourth of the occiput, black. Occiput cinereous white pollinose and pale yellowish pilose, the black occipital cilia extending downward to the middle of the eyes. Antennæ brown, the third segment yellowish basally on under surface.

Mesonotum shining black, thinly brownish pollinose except laterally, in the middle with traces of two paler brown vittæ. Pleura cinereous-white pollinose yellow pilose. Pile of the mesonotum, pteropleura, upper edge of the mesopleura and scutellum, black, the scutellum with black ventral fringe.

Legs black; tips of femora and bases of tibiæ reddish, posterior tarsi pale yellow, the apical segment brown, the basal segment black on the basal three-fourths. Hair black; yellow on the anterior four tarsi and pale segments of the posterior pair.

Wings blackish brown, the apical fourth or less cinereous. Alula large. Squamæ brownish yellow. Halteres yellow.

Abdomen shining black; second segment with a broad, opaque black fascia behind the middle which is usually produced forward dorsally to the basal third of the segment; third segment with a large, diffuse, subtriangular opaque black spot dorsally. Hair black, whitish on the immediate sides of the first segment and the first sternite. Abdomen strongly spatulate, the second segment cylindrical, slightly widening to the apex, the third more than twice as wide apically as basally.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, December 22, 1928. Paratypes: three males, Barro Colorado Island, December 22, 1928 and February 13, 1929, (Curran); one male, Rio Madeira, Abuna, Brazil.

There are two specimens from Chapada, Brazil (Williston Collection), which may belong here but they have no black pile on the pleura and have the notopleura pale pilose as in *clarapex* Wiedemann. They differ from *clarapex* in having only the apical fifth of the wing grayish and the first posterior cell not brown.

Baccha atypica, new species

A large, orange-colored species with black markings; wings yellowish brown in front; abdomen strongly spatulate; antennal segments of almost equal length. Length, 15 mm.

FEMALE.—Head orange; sides of face and the occiput cinereous-white pollinose; opposite the ocellar triangle and in front of it an opaque black spot; the lateral ones extending backward to the vertex and overlaid with whitish pollen. Pile of face short and fine, pale on lower half, black above; on the front very short, sparse, black; on the occiput long and pale yellowish. Antennal swelling large, its upper surface and a broad stripe between the antennæ blackish. Face moderately retreating, the tubercle large. Cheeks as wide as first antennal segment. Antennæ orange, the third segment mostly brownish, on the inner side all the segments of about the same length.

Thorax orange, shining, the mesonotum with four opaque black vittæ, the median pair broadly united opposite the inner ends of the suture and curving outward posteriorly to unite with the outer pair, the outer ones interrupted at the suture; on either side, immediately behind the suture, is a blackish spot. The pale vittæ separating the black ones are yellow pollinose. The pleura are practically bare while the hair of the mesonotum and scutellum is extremely short and black. The scutellum bears a rusty reddish or ferruginous band which may leave only the margins yellow; no ventral fringe.

Legs orange, the apical three segments of the posterior tarsi reddish brown; anterior tarsi broadened and flattened.

Wings brownish yellow in front of the third vein, in the first basal cell and in the anal cell, elsewhere cinereous hyaline. Upper squamal lobe yellowish brown. Halteres orange.

First abdominal segment pale orange, the second and third ferruginous with the base broadly paler; fourth and fifth segments black with the base broadly and the lateral margins pale orange, the black color containing a pair of slender orange vittæ which do not reach the posterior margin of the fifth or sixth segments nor the anterior orange band, but on the fourth segment the vittæ reach the pale fascia in front and are divergent posteriorly. The seventh segment is black except laterally. Hair black. The abdomen is very strongly constricted on the basal half of the second segment, widening from the middle of the second segment to the apex of the third.

MALE.—Frontal triangle reddish yellow. Vertical triangle dull black on anterior half, brownish yellow pollinose behind. Metanotum mostly black. Tibiæ becoming pale yellow apically, the anterior tarsi less broadened. Abdomen ferruginous with the bases of the segments broadly yellowish, the vittæ obsolete on the fourth segment. Genitalia reddish yellow, large, extending forward under the abdomen.

TYPES.—Holotype, female, Chapada, Brazil, November, (Williston Collection). Allotype, male, Rio Caiary-Uaupes, Amazonas, Brazil, 1906, (H. Schmidt).

This is the species recorded by Williston in his paper on Brazilian Syrphidæ as *conjuncta* Wiedemann. In *conjuncta* the abdomen has parallel sides but much the same color as in this species. This is a very distinct species and a new genus may have to be erected for it. It has been recorded from British Guiana by Hine as *conjuncta* Wiedemann.

Baccha prenes, new species

Related to *variegata* Macquart but without four yellow vittæ on the third abdominal segment. Length, 12 mm.

MALE.—Face and frontal triangle reddish yellow, the former darker in the middle and with a shining black spot above the middle. Pile black, yellowish on the lower third of the face and on the lower three-fourths of the occiput. Occiput black in ground color, cinereous pollinose except above. Vertical triangle black, brown pollinose. Face rather strongly retreating, the tubercle large. Antennæ brownish red, brownish above.

Mesonotum shining black, with two very broad grayish-brown vittæ on the anterior three-fourths, the lateral margins broadly yellowish. Pleura shining reddish yellow, a very broad greenish black band extending obliquely across the posterior part; pectus and metanotum metallic greenish black. Scutellum reddish yellow with sparse, long black hair and ventral fringe. Pile of mesonotum sparse, brownish yellow, becoming blackish posteriorly.

Legs reddish yellow, the posterior femora with a broad preapical brown band, their tibiæ with the apical third brown and a very broad brownish band before the middle. Hair mostly black, yellow on the tarsi, except the basal half of the first segment of the posterior pair. Middle coxæ brown.

Wings strongly tinged with yellowish brown; alula very narrow. Squamæ brownish yellow. Halteres reddish, the knob brownish.

Abdomen dull brownish black, the lateral margins and broad apices of the segments shining. First segment broadly yellow laterally. Second segment with an elongate, oblique yellow spot on either side, the front end of the spot near the middle of the segment and more pointed than the outer, posterior end, the sides of the segment broadly reddish on the anterior half. Third segment with yellow spots which are wider and more pointed anteriorly, their inner edges parallel, situated mostly in front of the middle of the segment. The yellow spots on the fourth segment are very similar to those of the third, reach the base of the segment and are slightly produced backward on their inner posterior ends. Fifth segment with two pairs of yellow spots, the inner ones forming a pair of elongate, posteriorly tapering triangular vittæ, the outer pair oval and narrowly separated from the inner ones at the base of the segment. Hair black, on the sides of the first segment, brown. Genitalia shining black.

HOLOTYPE.—Male, Rio de Janeiro, Brazil, November, (Williston Collection).

This species has been recorded by Williston as *variegata* Macquart.

Baccha murina, new species

Related to *prenes* but with longer and differently marked abdomen and wings. Length, about 16 mm.

MALE.—Face and front pale orange, the front with a polished black spot above the antennæ. Pile black, yellow on lower fourth of face and lower three-fourths of the occiput. Vertical triangle black, with brownish pollen; occiput black in ground color, cinereous pollinose. Face strongly receding below the tubercle. Antennæ reddish.

Mesonotum blackish, thinly brown pollinose, with three cinereous vittæ, the median one slender and entire, the outer ones broad and abbreviated posteriorly; the lateral margins broadly yellow; pile inconspicuous. Pleura yellowish, with a broad, oblique greenish-black band on posterior third, the sternum and metanotum similarly colored. Scutellum yellow, the pile inconspicuous, yellowish; no ventral fringe.

Legs reddish yellow; posterior femora brownish red, their tibiæ and the first segment of their tarsi, brown; anterior four tibiæ, anterior femora, and the tarsi, yellow-haired, the basal segment of the posterior tarsi black-haired, except the tip.

Wings tinged with brown, the anterior border darker on the basal half; alula very narrow. Squamæ yellow; halteres with brown knob.

Abdomen black and reddish, rather shining. First segment reddish yellow; second reddish on basal half, behind the middle with a triangular yellow spot on either side, its inner end pointed. Third segment rather stained but apparently mostly brownish red with a median vitta, posterior border and lateral margins black. Fourth segment with a reddish spot on either side, reaching to the middle of the segment and leaving a median vitta and the lateral margins black. Fifth segment wholly shining brownish black. Hair black. Genitalia shining black.

HOLOTYPE.—Male, Chapada, Brazil, November, (Williston Collection).

This species was labelled *variegata* Macquart in the Williston Collection.

Baccha mentor, new species

Related to *prenes*, new species, but the posterior tarsi are brown with the basal segment rather reddish. Length, about 12 mm.

MALE.—Face and front pale orange, the front brown pilose and with a small shining black spot above the antennæ. Occiput and vertical triangle black, the latter yellowish pollinose, the vertical triangle brown pollinose and black-haired; occipital cilia brown. Face very strongly receding below the tubercle. Antennæ reddish yellow.

Mesonotum shining black, with a pair of broad yellowish-brown pollinose vittæ, the lateral margins broadly yellow. Pleura shining yellow, posteriorly with a broad, oblique metallic green band, the metanotum and metasternum of the same color. Pile short, yellowish; scutellum yellow, with a few black hairs apically, without distinct ventral fringe.

Legs reddish yellow; a broad preapical band on the posterior femora, apical third of their tibiæ and a pre-median band and the posterior tarsi, brown, the basal segment of the posterior tarsi brownish red. All the coxæ yellow.

Wings with brown tinge; alula absent. Squamæ yellowish, the border tinged with brown. Knob of halteres brown.

Abdomen shining brownish black. First segment broadly yellow on the sides. Second segment with the sides very broadly red from the posterior fifth to well in front of the middle and also at the base. Third segment very broadly reddish on the sides from the base to the apical third; fourth segment similar; on the third and fourth segments the posterior margin of the reddish color is triangularly emarginate with black on the inner part. Fifth segment wholly black. Pile black, yellow on the sides of the first segment. The abdomen is very long and slender.

HOLOTYPE.—Male, San Bernardino, Paraguay.

Baccha macer, new species

Related to *mentor*, new species, but the wings are hyaline, the third vein curved forward beyond the middle of the apical cell, etc. Length, 11 mm.

MALE.—Face and front yellow, vertical triangle shining black; occiput cinereous-white pollinose. Pile yellowish. Antennæ reddish yellow, very short.

Mesonotum shining black, the sides and scutellum pale yellow, pile yellow, short and fine. Pleura yellow in front, shining greenish black behind. Sides of scutellum brown.

Legs yellow; posterior femora brown with a broad median band and the apex reddish yellow; posterior tibiæ brown with the basal fourth yellow, their tarsi brownish red with the apical two segments brown. Pile yellow, black on the posterior tibiæ and tarsi and on the apical brown band on the posterior femora, the black abundant on the under surface of the femora. Middle coxæ brown.

Wings hyaline; stigma brown; apex of wing tinged with brown along the costa. Alula absent. Squamæ with brown border. Knob of the halteres brown.

Abdomen shining brown with pale yellow markings. Sides of first segment broadly pale yellow, the second and third each with a broad, interrupted basal fascia. Second segment with a broad, narrowly interrupted pale fascia just behind the middle, the third with a similar fascia at the middle. Fourth segment yellow on almost the median half, with a median brown vitta and brown triangles projecting posteriorly along the sides of the segment. Genitalia produced and rather angulate on right side. The abdomen is very slender, widest at the apex of the fifth segment.

HOLOTYPE.—Male, San Bernardino, Paraguay.

Baccha deceptor, new species

Related to *stenogaster* Williston but the mesonotum is unicolorous and not reddish or yellow laterally; face with median black vitta except below. Length, 9 to 10 mm.

MALE.—Face yellow on the sides with a median triangular black vitta extending downward to the lower edge of the tubercle, the pile short and yellow. Frontal triangle blue-black, the sides pale yellowish pollinose, the pile black. Occiput bluish black, cinereous-yellow pollinose, pale yellowish pilose, the hair on the lower half scale-like and, in some lights, silvery. Vertical triangle blackish blue, black-haired. Antennæ brownish, broadly reddish or orange below.

Mesonotum shining black, the median third with rather thin grayish pollen which encloses two or three darker vittæ on the disc, the sides in front of the wings also pale pollinose. Pleura shining black, with bluish tinge, the posterior third of the mesopleura and a spot on the upper border of the sternopleura yellowish. Scutellum shining black, practically bare.

Legs reddish yellow; anterior coxæ brown except the apex, the middle pair black on outer surface; posterior femora brown with paler median band and apex and with yellow base; posterior tibiæ brown with a broad, median reddish band; tarsi brownish. Hair black.

Wings cinereous hyaline; stigma dark brown. Alula rather small. Squamæ yellow. Knob of halteres brown.

Abdomen long and slender, shining bronze-black, with some violaceous reflections and yellow markings. First segment with the sides pale yellow in front. Second segment beyond the middle with a subrectangular yellow spot on either side; third segment with a pair of basal and a pair of median spots similar in shape and size to those on the second. Fourth segment on either side with a very large, semi-oval spot resting on the base and reaching about to the middle of the segment. Hair black, whitish on the sides of the first segment.

FEMALE.—Front bluish, transversely wrinkled, the sides pollinose to the level of the ocelli. Pale spots on second abdominal segment reduced in size or absent.

TYPES.—Holotype, male, St. Croix Island, February 27, 1925. Allotype, female, St. Thomas Island, February 25, 1925, (F. E. Lutz). Paratypes: three females from Adjuntas, Porto Rico, June 5–7, 1915 and June 8–13, 1915, (Lutz and Mutchler); one female from St. Thomas, February 22, 1925, (F. E. Lutz).

These are the specimens recorded in my paper on the 'Diptera of Porto Rico and Virgin Islands' as *B. stenogaster* Williston. A comparison with Williston's type, which was from Brazil, shows that the West Indian form is quite distinct.

Baccha chapadensis, new species

Related to *mentor*, new species, but more robust, the abdomen shorter and more strongly widened toward the apex. Length, 11 mm.

FEMALE.—Face and lower two-thirds of front pale orange in ground color, the tubercle below the middle of the face. Front dull orange, the upper third opaque blackish, emitting a slender, brownish vitta which extends halfway to the antennæ; antennal tubercle shining, with a shining black spot in front. Occiput cinereous pollinose and wholly yellow pilose; front and upper fourth of the face black pilose. Ocelli situated at upper third of the front. First two antennal segments reddish, the third missing.

Mesonotum shining brownish black, with three cinereous white vittæ, the median one narrow and entire, the outer ones abbreviated behind; lateral margins broadly whitish yellow; pile short, yellowish. Pleura brownish black, thinly pale pollinose; mesopleura, a large spot on the sternopleura above and another above the front coxæ, pale yellow. Scutellum yellow, with short, black hair apically and short, not conspicuous ventral fringe.

Legs yellow, a broad, preapical band on the posterior femora, apical two-thirds of their tibiæ and the basal three-fourths of the first segment of their tarsi, brown; hair yellow, black on the dark portions.

Wings hyaline, the stigmal cell luteous. Alula large. Squamæ yellow; knob of halteres reddish brown.

Abdomen shining black, with reddish markings. First segment pale yellow with brown posterior margin. Second segment black with a broad, interrupted reddish fascia behind the middle. Third segment reddish on basal two-thirds with a broad median black vitta; the fourth similarly colored on the basal half. Fifth segment with four reddish vittæ, the median pair linear, outer pair broad, none reaching the apex of the segment; following segment shining black. Hair black, yellow on the sides of the first segment.

HOLOTYPE.—Female, Chapada, Brazil, (Williston Collection).

Baccha lineata Macquart

MACQUART, 1846, 'Dipt. Exot.,' Suppl. 1, p. 139 (f.).
Baccha tropicalis TOWNSEND, 1897, Journ. N. Y. Ent. Soc., V, p. 172.

A specimen of *tropicalis* Townsend agrees perfectly with Macquart's figure and description and there is little doubt that the synonymy is correct. This seems to prove that *lineata* came from Texas. Macquart gave the locality as Mexico or Texas. The species is rare in collections.

Baccha livida Schiner

SCHINER, 1868, 'Novara Reise,' Dipt., p. 343.
Baccha lineata HINE (not Macquart), 1914, Ohio Naturalist, XIV, p. 336.

Hine considered *livida* to be the same as *lineata* but in this he was wrong, as is indicated above.

Baccha incompta Austen

AUSTEN, 1893, Proc. Zoöl. Soc. London, p. 147.
CURRAN, 1928, 'Sci. Surv. Porto Rico and Virgin Islands,' XL, pt. 1, p. 36.

It is possible that the specimens from Porto Rico, and also one from the Republic of Honduras, may represent a distinct species, but inasmuch as I have less than a dozen specimens all told I hesitate to do more than point out a couple of differences. The tibiæ of the forms mentioned above are brown with reddish base and apex and the brown fascia on the wing is very much narrower and not subtriangular, as is the case in specimens from Panama and British Guiana.

Baccha adspersa Fabricius

FABRICIUS, 1805, 'Syst. Antl.,' p. 200.
?*Baccha punctata* SHANNON, 1927, Proc. U. S. N. M., LXX, Art. 9, p. 11.

Shannon's type has not been examined but the description agrees very well with specimens of *adspersa* form Brazil and Panama. *B. signifera* Austen may also be only an aberrant form of this species.

Baccha obscuricornis Loew

LOEW, 1863, Berl. Ent. Zeitschr., VI, p. 15, (Cent. III, No. 26).
Baccha cognata LOEW, 1863, Berl. Ent. Zeitschr., VI, p. 15, (Cent. III, No. 27).

The type of *obscuricornis* is a female from Alaska. *B. cognata* was described from a male from New York. These specimens represent the two sexes of one species.

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NEW SPECIES OF *LEPIDANTHRAX* AND *PARABOMBYLIUS* (BOMBYLIIDÆ, DIPTERA)

By C. H. Curran

During the identification of a number of Bombyliidæ it became necessary to revise the genera *Lepidanthrax* Osten Sacken and *Parabombylius* Williston in order to name satisfactorily the specimens in the collection. These revisions are presented here in the hope that they may prove of assistance to others when working over material in the two genera. While comparing specimens with types in the United States National Museum, additional specimens of some of the new species were located and these have been included in this paper. Unless otherwise stated, the specimens recorded are in The American Museum of Natural History.

Lepidanthrax Osten Sacken

Table of Species

1. First posterior cell divided by a cross-vein .... 2.
   First posterior cell not divided .... 5.
2. White patch on the sides of the second abdominal segment composed of scales .. 3.
   White patch on second segment composed of hairs which are at most a little widened .... *lutzi*, n. sp.
3. Third abdominal segment with pure white or silvery scales laterally .... 4.
   Third segment with tawny or orange scales laterally, wholly without white scales .... *morna*, n. sp.
4. Sixth abdominal segment without white scales .... *disjuncta* Wiedemann.
   Sixth segment with a silvery white cross-band .... *indecisa*, n. sp.
5. Face black or brown except at the sides .... 6.
   Face reddish in ground color .... 8.
6. A brown spot extends across the first posterior cell between the apex of the first vein and base of the second posterior cell .... 7.
   First posterior cell hyaline on its whole length .... *angulus* Osten Sacken.
7. Male with only the fifth segment silvery; face with dull tawny scales. *panamensis*, n. sp.
   Male with apical three segments silvery; face dull yellowish . . *proboscidea* Loew.
8. Wings wholly hyaline .... *hyalinipennis* Cole.
   At least furcation of the second and third veins clouded with brown; abdomen without black scales .... 9.
9. Costal border broadly brown for two-thirds its length ...... *lauta* Coquillett.
   Brown of the costal border broken into spots .... 10.

10. Front with black hairs at least on the upper half.. . ...11.
Front entirely pale-haired............ ... .*agrestis* Coquillett.
11. A brown cloud in the marginal cell in front of the fork of the third vein.
campestris Coquillett.
No brown cloud in front of the fork of the third vein......*inauratus* Coquillett.

Lepidanthrax lutzi, new species

Related to *disjuncta* Wiedemann but there are no silvery scales on the abdomen and the white hair on the sides of the second segment is not scale-like. Length, 10 to 11 mm.

MALE.—Head black; yellowish-brown pollinose, the occiput below and the cheeks more grayish; hair black; scales of the face and front whitish yellow or white, pure white and dense along the orbits. Occipital scales whitish. Palpi long and slender, brown, black-haired. Antennæ black, the third segment onion-shaped.

Mesonotum with scale-like tomentum which is white on the anterior half and sides and tawny on the posterior half, hair sparse, black; along the anterior border there is a fringe of tawny pile, behind which is a broader black fringe produced broadly back on either side over the notopleura and upper edge of the mesopleura to the root of the wings; above the wings and immediately in front of the scutellum with white, tomentum-like pile and black bristly hairs. Between the humeri and squamæ a very conspicuous band of white pile extends along the upper border of the pleura; below this the pile is a mixture of tawny, whitish and black; infrasquamal pile mixed black and tawny except against the squamæ and contrasting sharply with the white fringes of the squamæ and suprasquamal tuft; on the sternopleura the tomentum is mostly tawny but partly white on the upper portion and there are white patches above the posterior coxæ and behind the posterior spiracle. Scutellum with tawny tomentum except basally and laterally where it is white and with sparse, erect black hairs and six pairs of black marginal bristles.

Legs reddish; coxæ black, their scales chiefly black. Femora with black scales, and especially above and below, with scattered white and tawny ones. The predominating scales on the tibiæ are pale, whitish and tawny with irregularly placed black ones. Tarsi black with the basal segment or more reddish. All the tibiæ with bristles; front claws long.

Wings hyaline and brown, the brown markings a little variable in extent and intensity. In the darker specimens the costal border is very broadly brown to the end of the marginal cell, being interrupted beyond the apex of the subcostal vein; the marginal cell is brown to opposite the apex of the subcostal vein except for an elongate clear spot near its basal third; the brown fills the whole of the first basal cell and broad base of the first submarginal and first posterior cells; it extends to somewhat beyond the apex of the second basal cell but is interrupted within this cell by a clear spot at the apical fourth; behind the second basal cell the brown color extends obliquely across the basal fifth of the anal cell and base of the auxilliary cell. The apical brown fascia is irregular in shape, narrow posteriorly where it forms a broad border to the vein closing the discal cell and enclosing a subhyaline spot in the end of the marginal cell. The posterior angulation of the discal cross-vein also bears a brown spot. In some specimens the oblique apical fascia may be broken to form four or five weakly connected spots. Squamæ white. Halteres blackish.

Abdomen black in ground color, variegated with black, tawny and white. First segment with a basal band of pale tawny pile, black pilose posteriorly and on the posterior border weakly fringed with whitish scales; the sides white pilose. Second segment white tomentose on the basal three-fifths and white pilose on the basal two-fifths of the lateral margin, the posterior two-fifths clothed with rather equally mixed black and tawny scales and on the sides with broad black scales predominating from dorsal view and tawny scales from ventral view. On the third, fourth, sixth, and seventh segments the tawny scales are more numerous than the black but toward either side of the third and fourth segments there is a transverse area in which the pale scales are almost or wholly lacking; these two segments each bear a pair of broad, basal white spots which are broadly separated from each other in the middle; fifth segment almost all white-scaled on more than the basal half; sixth and seventh segments fringed posteriorly with white scales except medianly and with a few white scales basally on either lateral margin. The lateral margins bear abundant black scales, the bases of the segments with tawny scales and often some white ones. The venter bears mostly tawny scales but there are white and black ones intermixed and the white ones predominate laterally on the second and third sternites; ventral scales longer than the dorsal ones.

FEMALE.—Differs chiefly in having the white-scaled band on the fifth segment much less conspicuous and interrupted on either side and the fifth to seventh segments each bear an apical tuft of suberect black scales in the middle. The hair on the sides of the second abdominal segment is a little more scale-like but the scales are quite narrow. The venter bears more whitish scales than in the male.

TYPES.—Holotype, male, Mud Springs, Santa Catalina Mts., Arizona, August 19, 1916, altitude about 6,500 ft., (F. E. Lutz), in American Museum of Natural History. Allotype, female, Rio Ruidoso, White Mountains, New Mexico, July 21, altitude about 6,500 ft., (C. H. T. Townsend). Paratype, male, same date as allotype. The New Mexico specimens are in the United States National Museum.

Lepidanthrax morna, new species

This species resembles *proboscidea* Loew in wing markings and in body coloration but lacks silvery scales on the sixth and seventh abdominal segments and has a cross-vein bisecting the first posterior cell. Length, 6.5 to 9.5 mm.

MALE.—Head black, thinly brown pollinose, black-haired, the occiput with brownish yellow pile above; scales on the face, front and upper half of the occiput yellowish, on lower half of occiput white; face with a rectangle of black scales immediately above the oral margin. Palpi and antennæ black.

Mesonotum white tomentose in front, tawny on more than the posterior half; the front margin with a fringe of dull yellowish pile which merges into a broader band of tawny which extends over the notopleura and includes the upper border of the pleura but does not reach to the base of the wings; behind the tawny band a white-haired band of more tomentum-like pile which extends back laterally to the base of the wings. Scutellum with tawny, scale-like tomentum, the sides and base whitish. A stripe of white pile extends along the pleura from the humeri to beneath the squamæ, the infrasquamal tuft mixed tawny and black except above; below the white band the pleural hair is almost all black; the scale-like tomentum is black except for a few yellowish scales on the sternopleura above and a patch of yellow scales behind the posterior spiracle. Scutellum with six or seven pairs of black marginal bristles.

The legs appear to be wholly black although the femora are brownish red in ground color; the scales are shiny black with only a few scattered reddish ones. Bristles of the tibiæ small; front claws long.

Wings hyaline, brown in front and spotted with brown. Costal and subcostal cells brown as far as the apex of the costal cell. The brown at the base of the wing covers the base of the auxilliary cell, base of anal cell, basal half of second basal cell and the first basal cell although in this cell it is very pale at the basal third and apical fourth; a dark brown spot surrounds the anterior cross-vein and extends over the fork of the third vein to join the brown of the costa; in the marginal cell there is a large brown spot at the middle. The other five brown spots are distributed as follows: a small one surrounding the posterior section of the discal cross-vein; a narrow cloud along the anterior section of this same vein; rectangular spot covering the supernumerary cross-vein; a spot covering the base of the anterior branch of the third vein and extending to the costa; and a small spot near the end of the second vein. Squamæ pale yellowish, with white fringe. Halteres blackish brown.

Abdomen black, considerably denuded dorsally. First segment with a broad basal band of yellowish pile and a narrow apical fascia of black hairs, the scattered scales yellowish. Second segment with a white-scaled fascia occupying more than the basal half, the posterior part mostly black-scaled, with scattered tawny ones. The third and fourth segments appear to have the black scales predominating basally, the tawny ones apically; fifth segment with a broad basal band of white scales at least on the lateral third; the yellow scales predominate on the sixth and seventh segments which have a white apical fringe except in the middle. The sides of the abdomen are densely black-scaled, the sides of the second segment white-scaled on the basal half, the bases of the third and fourth segments bear a few tawny scales; the white scales on the fifth segment are not visible from below. Venter black-scaled, with scattered metallic yellowish scales which are most numerous laterally.

FEMALE.—The abdomen evidently bears more tawny scales than in the case of the male.

TYPES.—Holotype, male, Kits Peak Rincon, Baboquivari Mts., Arizona, August 1–4, 1916, alt. about 4,050 ft. Allotype, female, Sycamore Canyon, Santa Catalina Mts., Arizona, August 20, 1916, (F. E. Lutz).

Lepidanthrax indecisa, new species

Related to *disjuncta* Wiedemann but the male is at once distinguished by the absence of silvery-white scales on the fourth abdominal segment and their presence on the sixth and seventh. The oblique apical wing fascia is narrow in front and does not extend along the costa to the anterior branch of the third vein. Length, 7 mm.

MALE.—Head black, brownish pollinose, hair wholly black; scales yellowish with some brown ones intermixed on the face and front, pale yellowish on the lower half of the occiput. The black patch immediately above the anterior oral margin appears to be more bristly than scaly. Palpi and antennæ black.

Mesonotum dull black, with yellowish, scale-like tomentum; in front with a narrow fringe of yellowish pile; the black collar is broad and extends broadly along the sides, encroaching upon the pleura, to the base of the wings. Behind the black band the pile is pale yellowish and extends back along the lateral margin, gradually merging into the tomentum. A narrow stripe of yellowish white pile extends from beneath the humeri to the squamæ which bear a white fringe, the infrasquamal pile all black. The pleural pile is black but on the mesopleura and upper edge of the sternopleura there is considerable yellowish pile or tomentum and the spot behind the posterior spiracle is white.

Legs reddish in ground color, the coxæ and apical tarsal segments brown; coxæ with black vestiture. Femora with mostly black scales; tibiæ chiefly pale scaled above, black below. Bristles of front tibiæ moderately strong; front claws long.

The brown pattern of the wing is oblique; posteriorly it extends across the basal seventh of the auxilliary cell, basal fourth of anal cell, slightly obliquely and convexly from the basal sixth of the fourth posterior cell halfway across the discal cell, thence along the middle line of the discal cell almost to its middle; from this point it extends obliquely to the tip of the costal cell, being rectangularly cut off in each cell. The apical, oblique, brown fascia fills out the end of the marginal cell and extends backward to cover the vein at the base of the second posterior cell; a small brown spot covers the transverse vein at the base of the third posterior cell. Squamæ yellowish; suprasquamal tuft white. Halteres brown.

Abdomen variegated with scale-like tomentum and scales; in general the black scales appear to be greatly predominant on the apical half or more of the second, third fourth, and seventh segments, the deep yellowish scales being rather scattered, while there are white scales as follows: a broad fascia across the second segment; a narrow, probably medianly interrupted band on the base of the third segment; the fifth and sixth segments are silvery white and at least the sides of the seventh similarly colored. First segment yellow-haired on basal half or more, black-haired posteriorly and at least in the middle with long black scales. The lateral scales are wholly black from ventral view, but above there is a white patch on the sides of the second, third, fifth, sixth, and seventh segments. Venter with black and yellowish scales, the former predominating in the middle, the yellow ones laterally.

HOLOTYPE.—Male, Hacienda de la Imagen, Guerrero, Mexico, October, alt. 4000 ft., (H. H. Smith).

This specimen is one of those recorded under *disjuncta* Wiedemann in the 'Biologica Centrali Americani' and it is covered under Osten Sacken's remarks on that species. It differs in various ways from *disjuncta,* among others in having the anterior branch of the third vein joining the costa a great deal farther from the apex of the second vein.

Lepidanthrax panamensis, new species

Similar to *proboscidea* Loew but without silvery scales on the sixth and seventh abdominal segments of the male. Length, 6 to 9.5 mm.

MALE.—Head black, brownish pollinose, the sides of the face broadly reddish yellow in ground color; hair black, on the occiput yellowish white, broadly bordered with tawny above but black toward the vertex. Scales mostly tawny, a very few black ones on the front and face; those on the lower half of the posterior orbits rather yellowish; no tuft of black scales immediately above the oral margin. Palpi black, antennæ blackish, the basal two segments dull reddish, the second brown above.

Mesonotum dull blackish, with tawny tomentum, a fascia of yellowish white tomentum extends across the anterior fourth and curves backward laterally to reach the root of the wings; anterior collar of pile tawny, sometimes becoming pale yellowish in front and almost white at the sides, posteriorly with scattered black hairs. Scutellum with a narrow basal band and the sides clothed with yellowish-white tomentum; with three or four pairs of marginal bristles. The band of whitish pile extending from the humeri over the upper part of the mesopleura does not reach the base of the wing and is often greatly reduced or yellowish in color and not strikingly differentiated from the tawny pile. The mesopleura bears some black hairs among the tawny ones, the sternopleura is black-haired and the hair on the anterior part of the propleura is black, the pleural pile otherwise tawny. The patch of scales behind the posterior spiracle is yellow.

The legs are evidently reddish, the tarsi except basally, and the coxæ black; coxæ with mostly black scales. The color of the femora varies; in some specimens the black scales predominate, in others pale orange, the latter color predominating on the tibiæ. Bristles of front tibæ fairly strong; anterior claws long.

Wings brown and hyaline; the brown color forms an irregular broad costal border from the base to the end of the subcostal vein and there are three additional spots. Posteriorly the brown area does not quite reach the posterior border at the base of the discal cell: it extends transversely across the basal sixth of the anal cell, across the base of the fourth posterior and discal cells but broadly interrupted in the second basal apically, then extends transversely across the basal sixth of the first posterior cell and base of first submarginal, and is almost transverse behind the apex of the subcostal vein to the posterior edge of the marginal cell. There is always a hyaline spot at the basal sixth of the marginal cell and sometimes another halfway between this and apical limit of the brown. Apically there is an oblique brown fascia extending from the costa over the vein at the apex of the second posterior cell; a spot on the apical section of the second vein, usually connected along the vein with the brown fascia, a small spot on the anterior branch of the third vein and another on the vein at the base of the fourth posterior cell. Squamæ yellowish, their fringe and the suprasquamal pile white. Halteres brownish.

The abdominal scales are mostly tawny. First segment with yellowish pile and tawny scales. Second segment with a medianly interrupted broad band of white scales; third usually with a pair of moderately interrupted, transverse basal spots of whitish scales; fifth segment silvery white except apically; second to fifth segments each with two patches of erect, black scales posteriorly; in addition, appressed black scales may form more or less fasciate spots but they are for the most part scattered and are practically absent on the sixth and seventh segments. The sides of the abdomen bear long, broad scales, most of which are black; sides of the second to fifth segments with white scales basally but these may not be conspicuous on the third and fourth segments and may be mixed with tawny. The venter bears metallic-black scales intermixed with tawny.

FEMALE.—A patch of black hair immediately above the anterior oral margin; fifth abdominal segment with the band of white, non-silvery scales interrupted in the middle and toward either side; the paired patches of erect black scales occurring on each segment except the first.

TYPES.—Ten specimens from Panama Canal Zone. Holotype, male and allotype, female Patilla Point, January 15, 1929. Paratypes: three males, Patilla Point, January 15 and February 1; one male, Corozal, January 21; three males and one female Bruja Point, January 25, 1929, (C. H. Curran).

I have no female specimen of *proboscidea* so am unable to compare the two sexes of these species. The female of *disjuncta* has the seventh segment clothed with silvery scales.

PARABOMBYLIUS Williston

TABLE OF SPECIES

1. Abdomen with yellow pile in addition to the white spots.............2.
   Abdomen without yellow pile, but with several spots of white scales. *dolorosus* Williston.
2. Abdomen without black pile.............3.
   Abdomen with black pile.............4.
3. Halteres reddish.............*syndesmus* Coquillett.
   Halteres brown.............*ater* Coquillett.
4. Third abdominal segment with a large, oval patch of white scales toward either side, abdomen with black tomentum; face wholly black pilose. *vittatus*, n. sp.
   Third abdominal segment without white patch; abdomen with golden tomentum; face with golden tomentum and fine pile in addition to the black hairs.............*albopenicillatus* Bigot.

Parabombylius vittatus, new species

Allied to *albopenicillatus* Bigot but readily distinguished by the characters given in the table of species. Length, 5.5 mm.

FEMALE.—Head black; face and front black-haired, the latter golden tomentose; face above with a large patch of silvery-white hairs on either side. Occipital pile bright orange above, sparse and white below and on the cheeks. Palpi black. Antennæ black, black-haired, the third segment not haired apically, a little longer than the basal two segments combined but rather shorter than in *albopenicillatus*.

Mesonotum dull black, golden tomentose, the tomentum abundant anteriorly. There are four pure white vittæ composed of tomentum-like pile; two of these occupy the entire lateral margins and are quite broad; the median two are moderately wide and extend from the anterior margin to beyond the middle. The sparse pile is yellowish on the anterior half, black posteriorly and on the scutellum, the dorsal hairs on the scutellum very much finer than the five pairs of marginal bristles. Pleura black-haired; below the squamæ with white pile.

Legs black or brown; tibiæ reddish; anterior tibiæ with spicules; anterior claws moderately large.

Wings hyaline, the subcostal cell and base yellowish. First posterior cell closed in the wing margin or a little before.

Abdomen black; black pilose except the first segment which bears whitish pile; first segment, except medianly, with apical band of appressed, scale-like white tomentum; a large patch of similar color covers the entire sides of the fourth and fifth segments; toward either side of the third segment there is a patch of appressed, tomentum-like white scales and a smaller median patch on the tips of the second to sixth segments. The vestiture of the venter is wholly dark.

HOLOTYPE.—Female, Santa Cruz Village, Cobabi Mts., Arizona, August 10–12, 1916, alt. about 3,100 ft., (F. E. Lutz).

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NEW DIPTERA BELONGING TO THE GENUS *MESOGRAMMA* LOEW (SYRPHIDÆ)

BY C. H. CURRAN

Up to the present time no key for the separation of the species of *Mesogramma* has been published and determination is, therefore, a very tedious process inasmuch as the descriptions are scattered through numerous publications. Although there are still many species of which I have not seen representatives and which cannot be satisfactorily included, it is hoped that the following key may be a useful start.

In this genus there is, in some species, a great deal of variation in the color of the abdomen and forms occur in which the black markings normally present are entirely absent or but faintly indicated. The typical forms should trace out readily enough in the following key but difficulty may be experienced in the case of the pale-colored examples. Most of these may be readily identified in the male sex by comparison of the genitalia with species having the same general structure and coloration in other parts of the body.

TABLE OF SPECIES

1. Mesonotum with yellow lateral margins or with yellow markings laterally in addition to the yellow humeri..........6.
   Mesonotum with only the humeri yellow..........2.
2. Face with a median blackish vitta..........3.
   Face wholly pale-colored..........5.
3. Middle tibiæ whitish yellow..........4.
   Middle tibiæ with broad brown or blackish band..........*anthrax* Schiner.
4. Abdomen of female with opaque black markings, of male shining blackish and reddish..........*flavipleura* Hall.
   Abdomen of female shining (male with yellow face)..........*basilare* Wiedemann.
5. Anterior tibiæ with a blackish median band..........*nitidiventris*, n. sp.
   Anterior tibiæ wholly yellow..........*basilare* Wiedemann.
6. Margin of mesonotum black in front of the suture; humeri and sometimes a spot on the notopleura yellow..........7.
   Mesonotum laterally with at least a narrow yellow lateral stripe in front of the suture..........9.
7. Posterior tibiæ wholly yellow; abdomen with very broad yellow fasciæ. *planiventris* Loew.
   Posterior tibiæ black except the base and apex..........8.

8. Abdomen vittate. .... *boscii* Macquart.
Abdomen fasciate. .... 38.

9. Posterior femora and tibiæ yellow, at most with obscure reddish bands..... 10.
Posterior femora or tibiæ with black or brown bands.................... 18.

10. Abdomen with the lateral margins wholly pale yellow.................... 11.
Abdomen with the lateral margin in part black.................... 12.

11. Pale abdominal fasciæ transverse, interrupted and enlarged inwardly. *philippi* Shannon.
Pale abdominal fasciæ very broad, separated by a geminate vitta. *marginata* Say.
Pale abdominal fasciæ entire, without black markings..... *calceolata* Macquart.

12. Abdomen with entire, narrow pale yellow fasciæ which sometimes contain small black spots, the apical fasciæ sometimes sub-interrupted.............. 13.
Abdomen with interrupted or irregular yellow fasciæ; the segments usually with geminate vitta or all reddish.............................. 15.

13. Fifth abdominal segment with a median, basal black vitta............. ...14.
Fifth abdominal segment with basal and apical black fasciæ. *calceolata* Macquart.

14. Scutellum yellowish.................... *duplicata* Wiedemann.
Scutellum black with yellow border.................. *saphiridiceps* Bigot.

15. The geminate median vitta expands anteriorly on the segments to form a linear black fascia.................................. *polita* Say.
The geminate median vitta does not form a fascia anteriorly............... 16.

16. Pale abdominal fasciæ linear............................ *vierecki*, n. sp.
Pale abdominal markings broad.................................. 17.

17. Mesonotum with a bright blue median vitta.............. *tibicen* Wiedemann.
Mesonotum with three grayish vittæ, the median vitta rarely with bluish tinge; smaller species, under 8 mm.................................. 48.

18. Scutellum yellow, the immediate base black or the disc a little infuscated.... 19.
Scutellum black with yellow border or wholly black..................... 24.

19. The yellow fascia on the third segment bears no black markings except the median geminate vitta.................................. 20.
The yellow fascia is either broken up into spots or bears a black spot toward either side.................................. 22.

20. The black pile on the under surface of the posterior femora reaches almost to the base; middle femora short black pilose behind.................. 21.
The black pile on the posterior femora is limited to the apical half. *subannulata* Loew.

21. Fifth abdominal segment with narrow median vitta on the basal half; black spots in the cross-bands.............................. *norma*, n. sp.
Fifth segment with round or oval basal black spot in the middle; some of the pale bands with black spots or geminate median vitta................ 43.

22. The black spots in the yellow fasciæ are isolated, often minute.............. 23.
The black spots are connected with the black posterior border, leaving four irregular yellowish spots and a slender median vitta.... *maculata* Bigot.

23. The black spots on the third segment are linear and longitudinally placed or transverse.................................. 42.

The black spots are oblique and strongly separated from the anterior margins of the segments . . . . *laciniosa* Loew.

24. Second abdominal segment with a pair of lunulate yellow spots, their inner ends rather parallel with each other and produced posteriorly; often fused so that the middle of the segment is all yellowish. . . . . . *arcifera* Loew.

Second segment variable in color, the inner ends of the spots at most slightly produced posteriorly. . . . . 25.

25. Second abdominal segment entirely shining black, with small, obscure shining reddish spots medianly or only the lateral margins reddish. . . . . 26.

Second abdominal segment with a median yellow fascia or broadly reddish apically. . . . . 28.

26. A yellow spot above the anterior coxæ. . . . . 27.

No yellow spot above the anterior coxæ. . . . . *nitida* Schiner.

27. Yellow lateral vitta of the mesonotum entire; second abdominal segment always black or ferruginous on its whole width posteriorly. . . . . *floralis* Fabricius.

Yellow lateral vitta broadly interrupted immediately behind the suture; lateral margins of second segment wholly pale reddish. . . . . *lutzi*, n. sp.

28. Abdomen entirely reddish beyond the second segment. . . . . 37.

Abdomen with black markings beyond the second segment. . . . . 29.

29. Posterior tibiæ black or brown except the base and apex. . . . . 30.

Posterior tibiæ with apical third or more yellow or with sub-basal and subapical bands. . . . . 33.

30. Abdomen chiefly reddish, the black markings forming longitudinal vittæ. *boscii* Macquart.

Abdomen with broad black fasciæ and median vitta which may be geminate. . 31.

31. The black posterior fascia on the third segment is produced forward laterally at least to the anterior fourth of the segment. . . . . 32.

The black fascia is scarely produced forward laterally. . . . . *anchorata* Macquart.

32. The black of the third abdominal segment is most strongly carried forward sublaterally. . . . . 39.

The black of the third abdominal segment is widest laterally. . . . . 47.

33. Second abdominal segment broadly black basally. 34.

Second abdominal segment orange on more than the basal half. . . . *clara*, n. sp.

34. The black basal fascia on the second abdominal segment is very much wider than the yellow fascia. . . . . *maculata* Bigot.

The black basal fascia is scarcely wider than the yellow fascia. . . . . 35.

35. Third abdominal segment with three yellowish or reddish fasciæ. *saphiridiceps* Bigot.

Third abdominal segment with only one pale fascia or with longitudinal black markings. . . . . 36.

36. A yellow spot above the front coxæ. . . . . 40.

No yellow spot above the front coxæ. . . . . *picta* Schiner.

37. Second abdominal segment wholly reddish. . . . . *aurulenta* Williston.

Second abdominal segment mostly black. . . . . *panamensis*, n. sp.

38. Face black in the middle, at least above. . . . . *verticalis* Curran.

Face wholly yellow. . . . . *mitis*, n. sp.

39. The black on the third segment is triangularly produced. . . . . *confusa* Schiner.

The black on the third segment is convex or transverse on the anterior margin toward either side. . . . . 41.
40. Median black vitta on third abdominal segment geminate. .*floralis* Fabricius.
Median black vitta not geminate . . . . *imperialis* Curran.
41. First abdominal segment mostly yellow. . . . . *purus*, n. sp.
First abdominal segment almost all violaceous . . . . *violacea* Curran.
42. Sublateral black markings in the pale fascia on the third segment in the form of transverse, oval spots. . . . . *pulchellus* Macquart.
Sublateral black markings forming narrow, abbreviated vittæ. *musicus* Fabricius.
43. Posterior calli black-haired. *productus*, n. sp.
Posterior calli yellow-haired. . . . . 44.
44. Smaller species, 4 to 6 mm. in length, the fused posterior forceps of the male more than half as long as the broad lamellate outer forceps. . . . . 45.
Larger species, 6.5 to 7 mm. in length, the posterior forceps triangular and only about one-fourth as long as the outer forceps. . . .*duplicatus* Wiedemann.
45. The lamellate outer forceps of the male are deeply emarginate apically on their outer side . . . . *difficilis*, n. sp.
The lamellate outer forceps are not marginate but are longest on their outer side or evenly convex. . . . . 46.
46. Outer forceps obliquely truncate apically. . . . . *watsoni*, n. sp.
Outer forceps evenly convex apically. . . . . *tænia*, n. sp.
47. A yellow spot above the front coxæ. . . . . *tibicen* Wiedemann.
No yellow spot above the front coxæ. . . . . *slossonæ*, n. sp.
48. The pale abdominal fasciæ reach the lateral margins in more than half the width of the segment. . . . . *planiventris* Loew.
The pale fasciæ reach the lateral margin very narrowly in front. *floralis* Fabricius.

Mesogramma duplicatus Wiedemann

Syrphus duplicatus Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 142.
Syrphus ochrogaster Thomson, 1869, 'Eugenies Resa,' p. 494.

There are several specimens before me, including one of each sex compared with the types. It is certain that the Kertesz catalogue is in error in placing *tridentatum* Giglio-Tos as a synonym, and if Giglio-Tos correctly identified Rondani's species the name represents a perfectly valid species.

Several of the specimens which I formerly placed with *duplicatus* I now find represent two distinct species which differ only in their smaller size and the shape of the male genitalia, while still another species is quite as large as *duplicatus*, has the mesonotum mostly black-haired in the male, the posterior calli black-haired in the female and different male genitalia. In *duplicatus* the median projection between the lamellæ is little more than one-fourth as long as the lamellæ, while in the other three species it is almost two-thirds as long.

Mesogramma productus, new species

Very similar to *duplicatus* Wiedemann but the posterior forceps are linear and the mesonotum is partly black-haired. Length, 7 mm.

MALE.—Face strongly produced, yellowish red, the sides broadly white pollinose; frontal triangle reddish, with a bluish reflection in the middle. Occiput cinereous pollinose and white pilose. Vertical triangle long and narrow, bronzed behind, opaque blackish across the ocellar region, cinereous yellow in front, the pile black. Antennæ reddish yellow, the arista brown.

Mesonotum bluish black, median vitta bright blue, the sides broadly reddish yellow, the black part covered with rich brownish-ochreous pollen except laterally; pile blackish at least behind the suture. Mesopleura except anteriorly, a large spot on the sternopleura above, a large triangle on the pteropleura and a small spot above the front coxæ, reddish yellow; pleura pale yellow pilose. Scutellum dull orange, black-haired.

Legs reddish yellow; posterior femora with a broad preapical black band; posterior tibiæ blackish with the base and broad apex reddish; posterior tarsi blackish. Anterior four coxæ brown.

Wings cinereous hyaline; stigma luteous. Squamæ and halteres pale orange, the former with yellowish fringe.

Abdomen orange; first segment black apically; second segment with basal and apical black fasciæ of almost equal width, the median orange fascia slightly wider than either of the black ones. Third and fourth segments with the apical third black, the bands narrowly interrupted; in the middle with a more or less continuous geminate black stripe of which the arms diverge and are somewhat enlarged anteriorly. Fifth segment with an elongate oval opaque black basal spot in the middle and the posterior margin blackish. Genitalia ferruginous, shining black on the right side. Pile black, yellow on the sides of the basal two segments and venter.

FEMALE.—The black of the cheeks extends triangularly onto the lower part of the face at the sides. Front black, thinly reddish-brown pollinose, the sides narrowly orange on the lower three-fifths; pile black. Vertex and upper part of occiput with reddish-brown pollen. Orange fascia on second segment wider than either black one; fifth segment black apically, the sixth reddish with the sides black.

TYPES.—Holotype, male, and allotype, female, "Ecuador."

Mesogramma watsoni, new species

Figure 1

Similar in color to *duplicatus* Wiedemann but smaller and with different male genitalia. Length, 4–5 mm.

MALE.—Face and front yellow, the sides of the former broadly white pollinose. Vertical triangle long, rather dull black, the vertex brownish yellow pollinose; pollen in front of ocelli yellowish; immediately behind the ocelli broadly shining and more or less bronzed. Occiput cinereous pollinose and white pilose, the upper fourth or more brownish-yellow pollinose and yellowish pilose. Vertical triangle with black pile. Antennæ pale orange, the arista mostly brown. Face strongly produced.

Mesonotum greenish black, in the middle with a bluish-gray vitta, the sides broadly yellow and broadly bordered inwardly with shining black, the disc brownish yellow or pale brownish pollinose. More than the posterior half of the mesopleura, a large spot on the sternopleura, a triangle on the pteropleura and a spot above the front coxæ, yellow, the spot on the sternopleura white pollinose. Scutellum reddish yellow, black pilose. Mesonotum yellow pilose, at most a few black hairs on the posterior calli.

Legs reddish yellow; posterior femora with a rather narrow brownish preapical band, their tibiæ with an obscure sub-basal band of brownish, the basal and apical two segments of their tarsi also brown; anterior coxæ blackish on basal half.

Wings cinereous hyaline; stigma luteous. Squamæ and their fringe pale yellow. Halteres pale yellow.

Abdomen orange, with black bands and spots. First segment black with the narrow anterior and broad lateral margins orange. Second segment with the basal sixth and apical fourth black, the basal fascia not reaching the lateral margins. Third and fourth segments with the apical fourth black and with a pair of median spots toward the front, the remnants of the median geminate vitta; the black bands sometimes in part more or less dark reddish or ferruginous; black fascia opaque with the posterior part shining. Fifth segment with a median elongate oval spot at the base and the tip more or less continuously black. Genitalia with a large shining black spot. Pile black; yellow on first segment, sides of the second and venter.

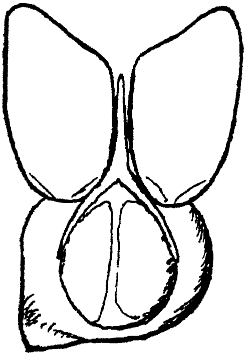
Fig. 1. *Mesogramma watsoni*, new species. Ventral view of male genitalia.

FEMALE.—Front black, the sides narrowly yellow to above the middle; thinly brownish yellow pollinose below the ocelli and thickly so at the vertex. The geminate stripes on the third and fourth abdominal segments are distinctly indicated; black spot at base of fifth segment subtriangular.

TYPES.—Holotype, male, Aux Cayes, Haiti, March 15–20, 1922, (F. E. Watson). Allotype, female, Yallahs Valley, Blue Mountains, Jamaica, February 27, 1911, (J. A. Grossbeck). Paratypes: male, same data as allotype; male, Guane, Cuba, September 24–26, 1913; female, Chapada, Brazil (Williston Collection); male, Aquadulce, San Lorenzo Mt., Colombia, December 26, 1922, (M. A. Carricker); male, Corumba, Brazil, December 14–23, 1919.

Mesogramma difficilis, new species

Figure 2

Related to *duplicatus* Wiedemann and similar in color in *watsoni*, new species, but with very different male genitalia and averaging larger in size, having a length of 5.5 to 6 mm. In both sexes this species agrees so closely with *watsoni* that it can only be definitely determined by an examination of the male genitalia. As a general rule, the pteropleura is less extensively yellow and has a strong bluish reflection on the anterior half except above; the black abdominal fasciæ appear more inclined to be poorly marked and they may be only faintly indicated on the third and fourth segments. In the female the opaque black spot on the fifth segment is more orbicular or wider apically instead of basally.

Types.—Holotype, male, Coamo Springs, Porto Rico, June 5–7, 1915, (Lutz and Mutchler). Allotype, female, Coamo Springs, July 17–19, 1914, (H. G. Barber). Paratypes: male, Caguas, Porto Rico, May 28–29, 1915, (Lutz and Mutchler); male, Adjuntas, Porto Rico, June 8–13, 1915, (Lutz and Mutchler); male, Manati, Porto Rico, March 5, 1914, (F. E. Lutz); female, Corozal, Porto Rico, July 2, 1915, (Lutz and Mutchler); female, Aibonito, Porto Rico, June 1–3, 1915, (Lutz and Mutchler); male, Tumatumari, British Guiana, July 11, 1911, (F. E. Lutz).

Mesogramma tænia, new species

Figure 3

Superficially similar to *duplicatus* Wiedemann but smaller and with differently shaped genitalia in the male. The outer forceps are evenly rounded apically and the length is only 4 to 4.5 mm.

Male and Female.—Except for differences in the male genitalia it is difficult to point to characters for the separation of this species from its allies. There is, however, a complete or partly formed narrow, yellowish pollinose, submedian vitta on the mesonotum; the opaque black spot on the fifth abdominal segment forms. in the female, a longitudinal spot which is about twice as long as wide; in the male the spot is more oval.

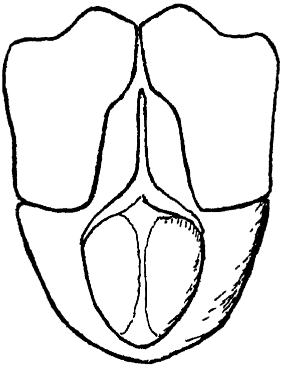

Fig. 2. *Mesogramma difficilis*, new species. Ventral view of male genitalia.

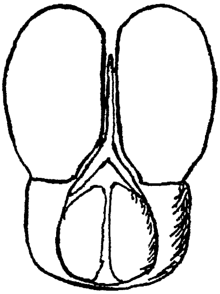

Fig. 3. *Mesogramma tænia*, new species. Ventral view of male genitalia.

Types.—Holotype, male, Corozal, Canal Zone, January 19, 1929. Allotype, female, Patilla Point, Canal Zone, January 15, 1929. Paratype, female, Barro Colorado Island, Canal Zone, December 27, 1928, (Curran). Another female, lacking its head, was taken by Dr. Lutz at Balboa, Canal Zone, November 7, 1923.

Mesogramma lutzi, new species

Related to *floralis* Fabricius but distinguished by the very broadly interrupted yellow lateral border of the mesonotum and wholly reddish lateral margins of the second abdominal segment. Length, 5 to 5.5 mm.

FEMALE.—Face moderately produced; yellow, with a broad median black or ferruginous vitta, the sides whitish pollinose; front broadly yellow on the sides to above the middle; the median dark vitta of almost equal width throughout. Front shining black, the vertex broadly cupreous or bronzed, in front of the scutellum brownish pollinose, the pollinose fascia emitting a median stripe reaching almost halfway to the antennæ and occupying the median half of the black vitta. Occiput cinereous pollinose. Pile whitish, black on the upper half of the front. Antennæ reddish yellow, the third segment broadly blackish above; arista brown.

Mesonotum greenish black in ground color, yellowish brown pollinose, in some views with wide median and sublateral grayish vittæ, in others with two brownish yellow ones. Lateral margins in front of the suture and on the posterior half behind the suture, broadly yellow. Posterior half of mesopleura, a large, ovate, contiguous spot below and a spot above the front coxæ, yellow. Scutellum black with the free border broadly yellow. Pile cinereous white, a few black hairs on the apex of the scutellum.

Legs yellowish, anterior four femora with a large, obscure, preapical brownish spot above, the posterior pair brown on the apical two-thirds except the apex; posterior tibiæ brown except the apex and broad base, with a broad reddish median band; tarsi and coxæ brown.

Wings cinereous hyaline; stigma luteous. Squamæ pale yellowish, with whitish fringe. Halteres reddish yellow.

Abdomen shining black with orange markings. First and second segments black with the sides orange. Third segment on either side with a large, subquadrate orange spot which is gently concave behind, is narrowly separated from the base of the segment except at the sides, is wider than long, and is produced triangularly backward along the lateral margin; the spots are wider than long and separated from each other by one-third the width of the segment, at their middle occupying less than the basal half of the segment. The spots on the fourth and fifth segments are similar to those on the third but their inner ends are produced more or less toward the posterior margin of the segment and less sharply defined. Pile pale yellowish basally and on the lateral margins, black dorsally.

TYPES.—Holotype, female, Frijoles, Canal Zone, November 8–15, 1923, (F. E. Lutz). Paratype, female, Fort Davis, Canal Zone, February 9, 1929, (Curran).

Mesogramma slossonæ, new species

Related to *basilaris* Wiedemann but with the lateral margins of the mesonotum yellow and the scutellum mostly black-haired. Length, 7 mm.

MALE.—Face and front reddish yellow, the sides of the former broadly whitish pollinose. Occiput cinereous pollinose, yellowish above, the vertex brown. Vertical triangle bronzed behind the ocelli, gray pollinose in front, the ocellar region opaque blackish. Pile whitish on the occiput, yellowish toward the vertex, black on the vertical triangle. Face moderately produced, most prominent in the middle. Antennæ orange.

Mesonotum æneous, brownish pollinose, the sides broadly reddish yellow; median stripe blue; toward either side with a grayish vitta, the area bordering the yellow margins shining. Pleura shining bluish black, the posterior half of the mesopleura and a large, contiguous spot on the sternopleura, yellow. Scutellum black, the free border orange; pile black on more than the apical half.

Legs reddish yellow; anterior four coxæ, preapical two-thirds of the posterior femora, their tibiæ, with the exception of the base, and their tarsi wholly black. Anterior four femora with a broad, preapical brownish spot above, the middle pair with indications of a second spot toward the base.

Wings cinereous hyaline; stigma luteous. Squamæ, their fringe and the halteres reddish yellow.

Abdomen black and orange. First segment black with the anterior border broadly orange laterally. Second segment black, with a slightly arched, sub-interrupted orange fascia on the anterior half, the fascia somewhat narrowed at the lateral margins; pale fascia bordered with opaque black except the sides. Third segment black, the anterior two-fifths in the middle orange, narrowed to one-fourth the length of the segment at the sides, interrupted in the middle by a broad, anteriorly expanded opaque black vitta, the orange band bordered with opaque black. Fourth segment orange with a large, sub-rectangular shining black spot on either side and a geminate median vitta on the anterior three-fifths. Fifth segment with a longitudinal, oval, opaque black spot basally in the middle and a sub-quadrate shining black spot on each posterior angle. Genitalia dark reddish, the right half mostly black. Outer forceps narrow, twice as long as wide. Pile black; cinereous on the first segment and sides of the second.

HOLOTYPE.—Male, Biscayne Bay, Florida, (Mrs. A. T. Slosson).

Mesogramma nitidiventris, new species

Abdomen shining black, the fifth segment with obscure reddish markings, sides of mesonotum æneous; face yellow. Length, about 8 mm.

MALE.—Head black, the face and frontal triangle reddish yellow, the sides of the former thinly white pollinose. Eyes touching for the length of only four facets. Vertical triangle long, violaceous at the vertex, deep blue immediately behind the ocelli, brownish ochreous pollinose in front, the ocellar region opaque black or deep brown. Pile of the vertical triangle black, elsewhere whitish or whitish yellow. Face concave above, only moderately produced. Antennæ reddish yellow, the arista black.

Mesonotum opaque brown, in some lights almost black, the sides broadly æneous, bordered interiorly by a narrow stripe of brownish yellow pollen, the median vitta cinereous. Humeri æneous, obscurely reddish behind; posterior calli obscurely reddish, emitting an obscure wide vitta anteriorly halfway to the base of the wings. Pleura æneous, thinly whitish pollinose, the posterior border of the mesopleura and an oval, contiguous spot below, pale yellowish; apical border of the scutellum narrowly yellowish. Pile of thorax and scutellum wholly whitish.

Coxæ and femora black, the apices of the latter reddish; tibiæ reddish, the anterior four with the median fifth, the posterior pair with the median three-fifths, blackish; tarsi reddish, the apical two or three segments brown. Femora wholly pale-haired.

Wings strongly tinged with brownish yellow; stigma luteous. Squamæ and their fringe white. Halteres reddish yellow.

Abdomen shining black, the sides of the fourth and fifth segments reddish, the fourth very narrowly so; fifth obscurely reddish on the apical half of the median two-thirds, the reddish color partly divided by a median production of the black basal ground color. Genitalia large, shining black, the left side dull reddish. Pile black, yellowish on the first segment and sides of the second.

HOLOTYPE.—Male, Victoria, Brazil, October.

Mesogramma norma, new species

Scutellum yellow; legs yellow, with black markings; abdomen black and yellow fasciate. Length, about 9 mm.

MALE.—Face, front and cheeks pale yellow, the sides of the face white pollinose. Face very strongly produced below, the oral margin very strongly oblique in profile; face and front with inconspicuous pile. Occiput and vertical triangle black in ground color, the former yellow pollinose and pilose. Vertical triangle long and narrow, yellowish pollinose in front and at the vertex, the ocellar region with black pollen, the space behind with violaceous or bronze reflections, the pile short and black. Antennæ yellow, the third segment broadly black above, arista black except its base.

Mesonotum olivaceous, the sides broadly pale yellow; thickly covered with brownish ochreous pollen, the median vitta blue, bordered with cinereous; there also appears to be a large, rectangular yellow spot on the anterior border contiguous with the humeri. Scutellum dull reddish yellow. The pale spots on the brownish pleura are very large, the spots above the front coxæ are yellow and the propleura is of the same color. Pile pale yellowish, black on the scutellum.

Legs yellow; a broad preapical band on the posterior femora, a median band on their tibiæ and the posterior tarsi wholly, brown.

Wings cinereous hyaline; stigma pale luteous. Squamæ yellow, with brownish border and brownish-yellow fringe. Halteres yellow.

Abdomen black and pale orange. First segment orange with a black posterior fascia on either side. Second dull black with an orange fascia which is about equal in width to the posterior black fascia but wider than the anterior one. The third and fourth segments are marked like the second except that the basal black fascia is very narrow and does not reach the lateral margins and the apices of the segments are obscurely reddish. Fifth segment orange with a median dull black vitta extending from the base to the apical fourth. Genitalia orange with a large, shining black spot. Pile black except on the first segment and basal angles of the second.

HOLOTYPE.—Male, Corozal, Canal Zone, January 16, 1929, (Curran).

Mesogramma purus, new species

Abdomen shining black and pale orange, the pale fasciæ entire; scutellum black with yellow border. Length, 6 to 7 mm.

MALE.—Face and front pale yellow, with inconspicuous pile; cheeks and occiput black, the latter yellow pollinose above, cinereous below, yellow pilose. Vertical triangle long and narrow, violaceous on posterior half, brownish yellow pollinose in front of the occelli, the ocellar triangle dull black; pile black. Face moderately produced. Antennæ pale orange, the arista black except at its base.

Mesonotum opaque black, with three grayish vittæ, the lateral margins broadly yellow; the median vitta is broad and lacks a blue tinge the sub-median vittæ have a yellowish tinge and are a little narrower than the black vittæ separating them from the median one; the black bordering the yellow sides is shining and somewhat metallic. Posterior half of mesopleura and a large, roundish contiguous spot below, pale yellow. No yellow spot above the front coxæ. Pleura shining blue-black. Scutellum shining black with the free border very broadly pale yellow. Pile reddish yellow, black on the scutellum and posterior calli.

Legs yellow, a preapical band on the middle femora, preapical third of posterior femora, posterior tibiæ except the base and apex and the apical three or four segments of the posterior tarsi, black. Front and middle coxæ brown.

Wings cinereous hyaline; stigma luteous. Squamæ with brown border and fringe. Halteres reddish yellow.

First abdominal segment pale orange, the posterior border irregularly black fasciate. Second segment with a broad basal black fascia which is slightly widened towards the sides, an orange fascia which may be either wider than or slightly narrower than the basal black fascia, the posterior two-fifths of the segment shining black, the pale fascia sometimes a little widened in the middle. Third segment with the posterior third shining black, the black color narrowly interrupted in the middle and always broadened on the lateral fourth where it reaches the basal fourth of the segment, the anterior margins of the black lateral areas either transverse or gently convex; from the inner ends of the black fascia there is usually a median geminate black vitta extending forward to the anterior fifth of the segment, the two lines composing it very narrow. Fourth segment similar to the third but the posterior black fascia is a little narrow on the median section and may be broadly interrupted on either side, in such cases leaving a large, rectangular black lateral spot. Fifth segment with three broad black vittæ which taper posteriorly, the outer two somewhat oblique. Genitalia large, short conical, black on the right side, orange on the left and ventrally.

TYPES.—Holotype, male, Corozal, Canal Zone, January 19, 1929. Paratypes: two males, Corozal, January 16 and 19, 1929, (Curran).

This species is close to *ciliatum* Giglio-Tos but the arms of the median geminate black vittæ are separated from the black lateral areas by fully three times the width shown in Giglio-Tos' figure.

Mesogramma clara, new species

Second abdominal segment orange with the apical fourth black; legs reddish yellow, the posterior pair black annulate. Length, 6 to 6.5 mm.

MALE.—Face and frontal triangle yellow, the face strongly produced. Cheeks, occiput and vertical triangle black in ground color; gray pollinose, the upper half of the occiput with yellow pollen. Vertical triangle violaceous on posterior half, the ocellar region opaque black, the triangle in front of the ocelli gray or yellow pollinose. Pile whitish, on the upper fourth of the occiput and vertical triangle, black. Antennæ reddish yellow; arista black except at its base.

Mesonotum dull black, partly opaque, the sides broadly yellow; a median gray vitta does not reach the posterior border. Pile black on the black portion and on the scutellum, yellow on the sides and pleura. Pleura metallic black, the posterior half or more of the mesopleura and a large, contiguous spot below, yellow. No spot above the front coxæ. Scutellum shining black, the free border broadly yellow.

Legs reddish yellow; anterior four coxæ brown or black on basal half; preapical fourth of the posterior femora black, the median half of their tibiæ and the apical two segments of the posterior tarsi, brown.

Wings cinereous hyaline. Squamæ yellow, with brown border and fringe. Halteres pale orange.

Abdomen orange and back, shining. First segment orange with the posterior border black except laterally. Second segment orange with about the apical fourth black. Third segment orange with the apical third, narrowed to almost one-fourth on the median third, black, the black fascia narrowly interrupted in the middle. Fourth segment orange with a large black spot on either side, the spots convex in front, reaching the basal fourth of the segment near their inner margins and narrowed at the sides to occupy only the posterior half; between these black spots is a ferruginous or at least darker reddish connecting fascia which is interrupted in the middle where a geminate brownish vitta reaches forward almost to the anterior margin of the segments, the two stripes forming it somewhat enlarged anteriorly. Fifth segment with three black vittæ, the median one tapering and usually reaching but little beyond the middle of the segment, the outer ones broad, their inner edges coinciding with the inner limits of the deep black spots on the preceding segment. Genitalia shining black.

FEMALE.—Front yellow on lower three-fifths, with a median bluish black vitta which widens anteriorly and is narrower above than the yellow lateral stripes. Pile sparse and yellow in front of the ocelli. Abdomen broader than in the male, the third segment with two small brown spots anteriorly representing the anterior ends of a geminate vitta; in other respects the markings are unusually similar to those of the male. Sixth segment broadly shining black on the sides and with an incomplete median vitta. Seventh segment polished black.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, February 18, 1929. Allotype, female, Barro Colorado Island, January 9, 1929. Paratypes: two males, Barro Colorado Island, January 10, 1929; one male, France Field, Canal Zone, January 18, 1929, (Curran); female, New Culebra, November 21, 1915, (T. Hallinan).

Mesogramma panamensis, new species

Differs from *basilaris* Wiedemann and *floralis* Fabricius in having the apex of the second abdominal segment broadly reddish. The genitalia are rather similar to those of *floralis* but there is no yellow spot above the anterior coxæ. Apical three abdominal segments wholly dark reddish. Length, 5 mm.

MALE.—Face and frontal triangle yellow, the former broadly white pollinose on the sides. Cheeks black. Occiput gray pollinose, with yellow pollen on the upper fifth, the pile silvery white. Vertical triangle long and narrow, brownish yellow pollinose in front, opaque blackish around the ocellar triangle, the posterior half bronzed or violaceous; pile black. Pile of upper part of the occiput yellowish, of the face, inconspicuous and white. Face rather strongly produced. Antennæ reddish yellow, the third segment pale brown above; arista brown.

Mesonotum greenish black, the sides broadly shining, the disc brown pollinose with a conspicuous, broad, median gray vitta and less conspicuous, bluish-gray vittæ bordering the shining lateral margins. In some views the opaque brown stripes show an inclination to develop medianly into narrow, brownish yellow vittæ. Humeri yellow; from the inner ends of the humeri a narrow brownish-yellow vitta extends to the suture; behind the suture the lateral margins are obscurely brownish yellow. Posterior half of mesopleura and a large, contiguous spot below, yellow, more or less whitish pollinose. Pile yellow, at most a few black hairs on the apex of the scutellum; scutellum shining black, the apical border broadly dull brownish yellow.

Legs reddish yellow; a broad preapical black band on the posterior femora; posterior tibiæ brown, the base and apex yellow, an obscure median band of reddish; posterior tarsi brown. Front and middle coxæ æneous.

Abdomen shining deep reddish with black base. First segment shining black. Second segment shining black basally, with a large, oval transverse spot of opaque black which is broadly connected in the middle with the black base; posterior margins laterally and the lateral margins on the posterior fifth narrowly blackish. Genitalia with a large shining black spot. Pile black, yellow on the base, lateral margins and venter.

TYPES.—Holotype, male and one male paratype, Panama City, Panama, December 20, 1928, (Curran).

Mesogramma mitis, new species

Related to *verticalis* Curran but the face wholly yellow. Length, 4.5 mm.

FEMALE.—Face moderately produced, reddish yellow, the sides broadly white pollinose. Front bluish black, opaque on upper two-fifths, the sides narrowly yellow to above the middle, the dark frontal vitta widest at the level of the antennæ. Occiput and cheeks cinereous pollinose, pile whitish, black on the upper third of the front. Antennæ reddish yellow; third segment brown except below; arista brown.

Mesonotum bronze-black in ground color, dark brownish pollinose, with three narrow cinereous vittæ, toward the sides strongly bronzed; lateral margins broadly yellow behind the suture, in front of the suture blue-black, the humeri yellow. Posterior half of mesopleura, a large, contiguous spot below and a small spot above the front coxæ, yellow. Scutellum dull black, the free border broadly yellow except at the immediate base.

Legs reddish yellow; a broad preapical band on the posterior femora, their tibiæ except the base and apex and their tarsi wholly, brown; anterior four tarsi becoming brownish apically.

Wings cinereous hyaline; stigma pale luteous. Squamæ yellow, with whitish fringe. Halteres reddish yellow.

Abdomen black, with orange fasciæ. First segment shining black with the anterior and lateral margins orange. Second segment with a rather narrow, narrowly interrupted orange fascia lying immediately in front of the middle of the segment and bordered by opaque black. Orange band on third segment wider, narrowly separated from the base of the segment and triangularly emarginate in the middle posteriorly and at the lateral margin; fourth segment similar but the pale fascia interrupted. Fifth segment with the orange band broadly interrupted in the middle and with the inner ends triangularly produced backward to the apical fourth of the segment. Sixth and seventh segments black. The orange fasciæ are bordered with opaque black, the narrow lateral margins and very broad apices of the segments shining black. Pile black, yellow on first segment and sides of the second.

HOLOTYPE.—Female, Montego Bay, Jamaica, March 6, 1912.

Mesogramma vierecki, new species

Face reddish, very strongly produced; scutellum orange; abdomen with very narrow orange fasciæ. Length, 8 mm.

Female.—Face reddish, with a large rectangular black spot connected with the black cheeks on the lower half. Front black, the orbits with linear yellow stripe on the lower three-fifths; apparently pollinose in front of the ocelli, behind the ocelli violaceous; sparsely black pilose. Occiput cinereous yellow pollinose and white pilose. Antennæ brownish red, the arista brown.

Mesonotum opaque black, the sides broadly reddish; pile black; humeri yellow; inside each humerus a large, rectangular cinereous pollinose spot. Posterior half of the mesopleura, an obscure spot below and a triangle on the upper anterior part of the pteropleura, reddish. Scutellum orange, black pilose.

Legs reddish, the anterior four coxæ, except their apices, and the posterior tarsi wholly, black; wholly black-haired.

Wings cinereous hyaline; stigma luteous. Squamæ orange, with short yellow fringe. Halteres orange.

Abdomen shining black, the basal half of the second to fifth segments opaque and bearing a narrow orange fascia, which crosses the basal third of the segment. First segment bordered with orange in front. The fascia on the second segment is linear, tapers toward the lateral margins from which it is broadly separated and is obscurely interrupted in the middle. Fascia on third segment about one-fifth as wide as the length of the segment, of equal width and produced forward at the lateral margin almost to the base of the segment. Fourth segment with similar fascia but it is slightly narrower and is narrowly interrupted in the middle. Pale fascia on fifth segment still narrower and broken up into four elongate spots. Sixth and seventh segments polished black. Pile black; cinereous on first segment, sides of the second and whole of the venter.

Holotype.—Female, Sero Quenado, Colombia, December 12, (H. L. Viereck).

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ADDITIONS TO THE PLEISTOCENE OF FLORIDA

BY GEORGE GAYLORD SIMPSON

INTRODUCTION

In three previous papers two Pleistocene mammalian faunas from Florida have been described and a general résumé of the fossil land mammals of that State has been given.[1] A recent trip to Florida and various new discoveries there have added to previous knowledge. The notes here published include some brief stratigraphic data and description or mention of some important new fossils. The opportunity to make these observations and to study these specimens was due to the cooperation and kindness of Mr. Herman Gunter, Mr. Walter W. Holmes, and Mr. J. E. Moore

ITCHATUCKNEE RIVER

The Itchatucknee River rises from several large springs southwest of Columbia in Columbia County and flows in a southerly direction into the Santa Fé River. The Ocala limestone is here at or near the surface, but in places there is a shallow layer of soil and in the bed of the river there is deep muck or ooze. It is said that three skeletons of mastodons were found in this river 35 or 40 years ago. These are said to have been mounted by Dr. J. Kost, first state geologist, but removed at the time of his retirement. Various other teeth and bones, chiefly mastodon or mammoth, have been found in or near the river.

Recently J. Clarence Simpson of High Springs has made a considerable collection of artifacts from the Itchatucknee River. The method of collecting is to wait until the water is low, then to wade about in the ooze until the bare feet encounter some hard object which may be recovered. In addition to arrow heads, some extraordinary awls or points of bone, apparently fossilized, were found, and also various remains of extinct animals. The association of artifacts and extinct animals is not important, in view of the type of deposit, but the animal remains are of some interest in themselves. The most important of these were presented by Clarence Simpson to the Florida State Geological Survey, and placed in my hands for study by Mr. Gunter. A preliminary list has already been published.[1]

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[1] Simpson, G. G. 1928. Pleistocene mammals from a cave in Citrus County, Florida. Amer. Mus. Novitates, No. 328.
———, 1929. Pleistocene mammalian fauna of the Seminole Field, Pinellas County, Florida. Bull. Amer. Mus. Nat. Hist, LVI, pp. 561–599.
———, 1929. The extinct land mammals of Florida. Fla. State Geol. Surv., 20th Ann. Rept., pp. 229–280.

The following is a revised list:

Didelphis virginiana
Ondatra zibethica
**Neochœrus pinckneyi*
Castor canadensis
Euarctos sp.
*?*Arctodus* sp.
Procyon lotor
Lutra canadensis
**Mylodon harlani*
**Equus complicatus*
**Tapirus* sp.
Odocoileus osceola
**Mylohyus ?pennsylvanicus*
**Bison* sp.
**Mastodon americanus*
**Parelephas ?columbi*

This is the first record of *Ondatra zibethica* from Florida, two very characteristic jaws having been found here. In the recent fauna its place is taken by *Neofiber alleni*, which is also common in the Pleistocene. The beaver is also new to the Pleistocene fauna, although it is said to have ranged into the northern part of the state in recent times. It is represented by a single jaw which is very robust, but not more so than in some specimens of *Castor canadensis*. This may relate it to the subspecies *carolinensis*, the recent southeastern beaver, which is large, but I have been unable to make direct comparison.

Lutra canadensis is not a new record, but the present specimen is unusually perfect. It is very close to *L. canadensis vaga*, the otter of recent Florida. *Mylohyus* is also no new record, but the present material is unusual, perhaps unique, in preserving the post-dental part of the lower jaw quite completely. The specimen agrees more nearly with *M. pennsylvanicus* than with other species.

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[1] 20th Ann. Rept. Fla. State Geol. Surv., p. 270.
*Extinct.

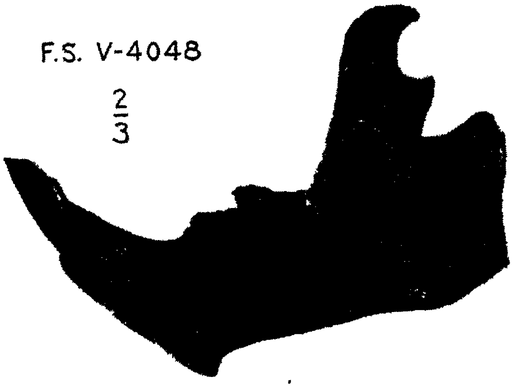

Fig. 1. *Castor canadensis.* Right lower jaw from the Itchatucknee River, internal view. Florida Survey, No. V4048. Two-thirds natural size.

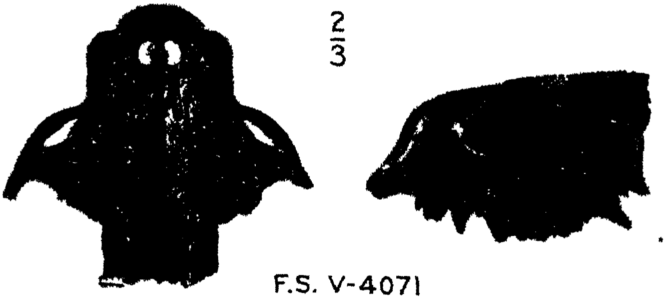

Fig. 2. *Lutra canadensis.* Anterior part of skull from the Itchatucknee River, palatal and left lateral views. Florida Survey, No. V4071. Two-thirds natural size.

SEMINOLE FIELD

The name Seminole Field has been applied by Holmes to an area in the south central part of Pinellas County northwest of St. Petersburg. From 1924 to 1927 this field was worked under the direction of Mr. Holmes, and the mammals included in the remarkably rich collections of those years have been described elsewhere.[1] These collections were from the vicinity of Joes Creek, an area now designated Station A by Holmes. In 1929 he worked over a similar deposit about two miles south of Station A and designated it as Station B. The fauna is identical with that of Station A but much less extensive. The principal items of interest are scutes of a large and well preserved glyptodont. These will be described elsewhere.

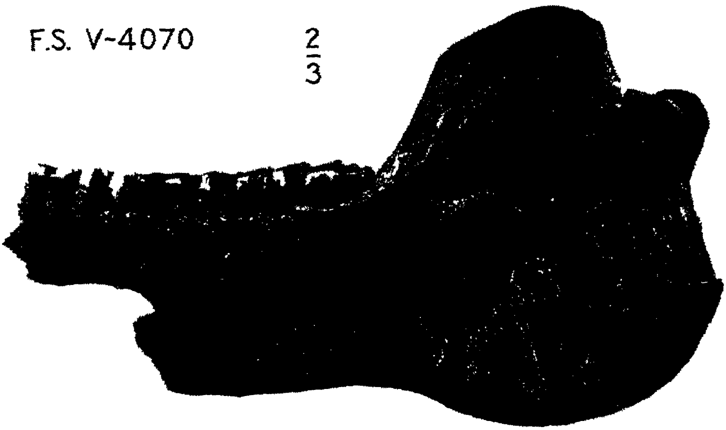

Fig. 3. *Mylohyus ?pennsylvanicus*. Posterior part of left lower jaw from the Itchatucknee River, internal view. Florida Survey, No. V4070. Two-thirds natural

The section at Station B is as follows:

Black sandy soil	1′ to 1′ 6″
Yellow tenacious clay	1′ 6″
Dark unconsolidated sand	3′
——*Unconformity*——	
Clean white sand, many shells.	

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[1] Simpson, 1929. Bull. Amer. Mus. Nat. Hist., LVI, pp. 561–599.

The three upper beds intergrade conformably. The fossils are almost confined to the lower six inches above the unconformity. Just above this most fossiliferous layer is a zone with numerous lime concretions. In and above this concretionary zone a few fossil bones were found. The ground water level in February, 1929, was nearly at the top of the dark fossiliferous sand, while the white marine sand is but little above the present sea level. The yellow clay of this section contains patches of bog-iron ore not far north of here and also contains a few broken shells in some places. It apparently represents a temporary depression of the area to several feet below its present level. The superficial stratum in this area may contain nodules or broad plates of sandy concretionary limestone.

The deposits at Station A are similar in a general way. A typical section is that at the No. 1 glyptodont locality, two hundred yards west of the bridge across Joes Creek:

Dark yellow sandy soil with many lime nodules and plates	1′ 6″
Lighter yellow sand, little clay	1′ 4″
Dark colored sand with bright yellow spots, fossil stratum	6″
——*Unconformity*——	
White sand with marine shells	

The thickness may be considerably greater than here, due to the somewhat uneven present topography and also to the uneven surface at the unconformity.

The general features are the presence of a white marine sand of unknown thickness, its upper surface a definite erosional unconformity, overlain by several feet of conformable terrestrial and fluviatile deposits. These later deposits are variable and have only a vague general tendency to be separable into two parts, an upper level of yellow sand and loam with numerous hard limy concretions and lenses, and a lower level of yellow to drab or mottled sands and sandy clays with fossil bones usually present near the bottom.

BRADENTON

An important new locality for fossil mammals was found by Mr. J. E. Moore of Sarasota at a point about one mile south of the business district of Bradenton. The locality was visited by Mr. Holmes and myself, and Mr. Moore generously proposed that the material already found, as well as the direction of further work, be turned over to the

American Museum. Carl Sorensen, of the Museum staff, worked here under the direction of Mr. Holmes in February and March, 1929, and made a large collection.

The fossils occur in the bank of a drainage canal about 100 yards east of the Tamiami Trail. The section at this point is as follows:

Brown loam, darker above	1′ 4″
White and yellow mottled sand	10″
White sand	2′ 6″
Irregularly intercalated brown and white sands	1′ 6″
White sands	1′ 6″
Dark brown sand, becoming deeper northward into the bank, and containing all the fossil bones	1′ +
——*Unconformity*——	
Clean white sand with many shells especially near top	3′ +
(Water level)	

Details are almost infinitely varied, but this is typical of occurrences over most of western Manatee and Sarasota Counties. The presumable Anastasia equivalent below is a white marine sand bounded by a very sharp unconformity. The series above this is conformable throughout, highly variable, sand and loam, the lower part generally dark in color, the upper white, buff, yellow, to brown. The fossil bones almost always occur in the lowest part of this terrestrial or fluviatile series, within a foot or two of the marine sand, although there are occasional exceptions.

The most impressive material from this locality includes teeth, jaws, skulls, tusks, and skeletal parts of a new mammoth of the genus *Parelephas*. At least five individuals appear to be represented. A preliminary notice of this form by Professor Osborn has appeared elsewhere.[1] Other specimens of great importance include especially bison horn-cores and other remains, and a capybara skull. The fauna is as follows:

Neochœrus pinckneyi
Odocoileus sp. indet.
Tanupolama sp. indet.
Bison latifrons
Parelephas floridanus

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[1] Osborn, H. F., 1929. American Museum Novitates, No. 393, Dec. 24, pp. 19–20.

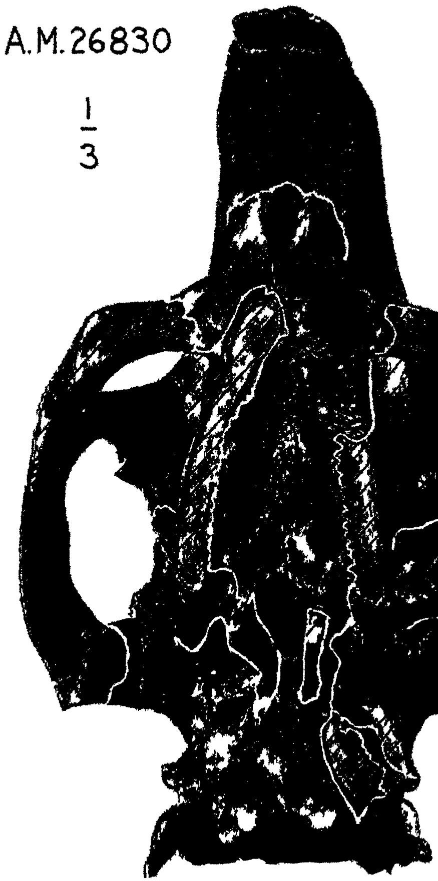

Fig. 4. *Neochœrus pinckneyi.* Skull from near Bradenton, palatal view. Cross-lined part restored A. M. N. H. No. 26830. One-third natural size.

Neochœrus pinckneyi

Hay recorded the presence of a capybara in Florida,[1] and I have suggested that there are two species present, one smaller, named *Hydrochœrus holmesi*, and one larger, compared with *H.* or *Neochœrus pinckneyi.*[2] The present material, although fragmentary, permits the restoration of the skull. It is of remarkable interest, not only as the best fossil specimen of this group yet found but also as revealing most of the skull characters of a gigantic rodent as large as *Castoroides*, hence ranking as one of the largest members of its Order.

There are no parts comparable to the type of *H. holmesi*, but the present specimen indicates a considerably larger animal. M^3 is missing but its aveolus indicates a tooth closely comparable to that from South Carolina described by Hay as *Hydrochœrus pinckneyi.*[3] Hay later described a fragment of a lower jaw and an M^4 from Texas, referring them to this species and to a new genus *Neochœrus.*[4] The Bradenton skull is probably referable to the same species as the Charleston specimen. It makes more positive the distinctions of these larger fossil specimens from the living capybara and perhaps validates their generic separation.

Of the dentition, P^4 and M^2 are preserved on the left side, with complete alevoli of M^1 and the inner wall of the alveolus of M^3 on both sides. The cheek series probably measured about 115 mm. in length at the mouths of the alveoli, whereas it is only 84 mm. in length in an unusually large recent capybara. P^4 is like that of the recent animal save for the very marked peculiarity that the external surface of the second plate (or posterior wing of the first pair) is strongly indented vertically, so that there are five external angles rather than four as in *Hydrochœrus* proper. M^1, from its alveolus, appears to have resembled that of the living form save in size, and M^2 is quite similar. M^3 was a very large, long tooth. It had at least 15, and possibly one or two more, inner angles, so that it must have had at least 16 and perhaps as many as 18 outer angles. *Hydrochœrus* has 13 inner and 14 outer. Hay's type of *Neochœrus pinckneyi* has 17 outer.

The palate is more deeply arched, but closely similar to *Hydrochœrus* in proportions. At the anterior ends of the palatines (which are fused at the midline) are two vascular foramina, and there is another conspicuous pair in the maxillaries, in advance of these, and other smaller ones.

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[1] 1923. Pan-Amer. Geol., XXXIX, p. 103.

[2] Simpson, 1928. Amer. Mus. Novitates, No. 328, p. 7; 1929, 20th Ann. Rept. Fla. State Geol. Surv., pp. 251, 264, 268, 270.

[3] Hay, O. P. 1923. Carn. Inst. Pub. No. 322, p 364; 1923, Pan-Amer. Geol., XXXIX, p. 103.

[4] 1926. Proc. U. S. Nat. Mus., LXVIII, Art. 24, p. 5.

The anterior roots of the zygomata and the maxillary region in front of and between them are broader and more flattened than in *Hydrochœrus.* The roots are much larger and relatively thicker (vertically) but in spite of their larger size their distance above the mouths of the alveoli is about the same as in the living form.

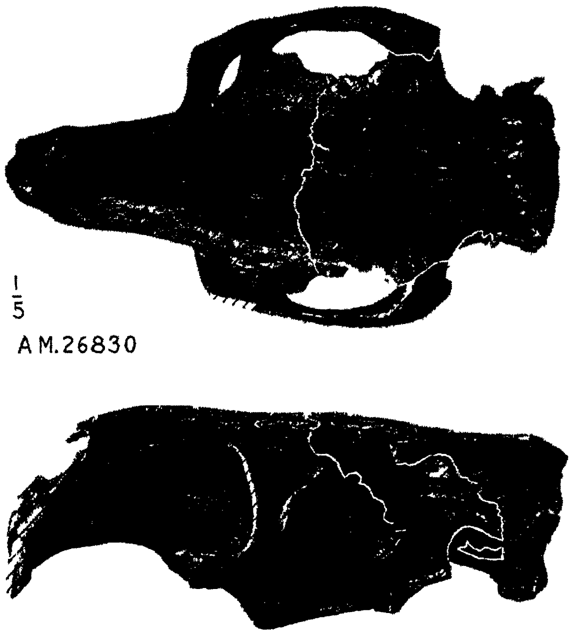

Fig. 5. *Neochœrus pinckneyi.* Skull from near Bradenton, superior and left lateral views. Cross-lined parts restored. A. M. N. H. No. 26830. One-fifth natural size.

It is the skull roof that most obviously distinguishes the fossil and recent animals. The frontal region in the fossil is very broad and nearly flat. The sagittal crests on the parietals narrow very rapidly: at the postorbital processes they are nearly twice as wide as in *Hydrochœrus,* while at the contact with the supraoccipital (or interparietal?) they are of almost exactly the same width as in the latter. The roof of the parietals is not arched and does not curve downward posteriorly, but continues the plane of the frontals and rises to a point at the supraoccipital suture. The interparietal part of the supraoccipital is relatively longer in the fossil, and the occiput is relatively higher.

The basifacial—basicranial flexure was probably somewhat less than in *Hydrochœrus*. The basioccipital-basisphenoid angle is less sharp than in the latter. The glenoid surfaces are somewhat lower relative to the basicranium.

Some typical measurements follow, with those of a large recent capybara and of a specimen of *Castoroides ohioensis* for comparison:

	Neochœrus pinckneyi	*Hydrochœrus capybara*	*Castoroides ohioensis*
Length of skull, excluding incisors..	ca. 350 mm.	254 mm.	302 mm.
Width across zygomata......... ..	ca. 210	133	ca. 225
Minimum width of skull roof at interorbital constriction..	124	67	64
Width across paroccipital processes.	115	83	165
Depth of occiput to lower edge of foramen magnum................	93	67	72
Maximum depth of skull in molar region..............	ca. 105	ca. 70	ca. 120

The proportions of *Neochœrus* and *Hydrochœrus* differ somewhat, but the extinct form appears to have been about 40% larger than a robust recent capybara. The proportions of *Neochœrus* and *Castoroides* differ so greatly in almost every particular that exact comparison is impossible, but their heads appear to have been of about the same bulk. The skull of *Neochœrus* is about 15% longer, but the average outside depth and width were probably slightly less. The two forms must henceforth share the title of largest known North American rodents. hitherto granted without question to *Castoroides* alone.

Bison latifrons

The occurrence of a large *Bison* in the Pleistocene of Florida has long been known. It has been found at twenty or more localities throughout the State. Good specimens have been so rare, however, that specific determination of any of this material has not yet been made. Horn cores, indispensible for the exact determination of any species of bison, have been unknown except for a specimen from near Grove City which was not figured and has been lost. In the Bradenton quarry were found numerous bison bones, a lower jaw, part of a skull, and part of a second skull with one horn core nearly complete and the base of the other.

The limb bones and the lower jaw (with $M_{\overline{1}-\overline{3}}$ preserved) agree with specimens from the Seminole Field,[1] and elsewhere and represent the common Pleistocene bison of Florida. There can be little doubt that the skull fragments and horn cores belong in the same species as the teeth and limb bones, so that this species may now be definitely identified. It is *Bison latifrons*.

In the Bradenton specimen the horn cores are smaller by about 5%, or a little more, than in the type or principal referred specimens of *B. latifrons*. The distance between the horn cores is smaller in proportion to the size of the horn cores than in the Adams County, Ohio, specimen described by Allen, Lucas, and Hay. The horn cores do, however, agree almost exactly in proportion, curvature, and general form with typical *B. latifrons* and differ in one respect or another from all other established species of the genus. The narrow frontal region may be a sexual character, associated with the slightly smaller horns.

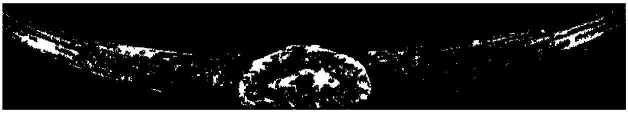

Fig. 6. *Bison latifrons*. Horn cores and posterior part of skull, from near Bradenton, views from above and slightly behind (upper), and from behind and slightly below (lower). The tip of the left horn-core and about two-thirds of the right are restored. A. M. N. H. No. 26828. One-twentieth natural size.

Approximate measurements follow (based on partly restored specimen).

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[1] Simpson, 1929 Bull. Amer. Mus. Nat. Hist, LVI, p. 598.

Width between horn cores		300 mm.
Length of core on upper curve	ca.	760 mm.
Length of core on lower curve	ca.	795 mm.
Maximum diameter of base		160 mm.
Minimum diameter of base		135 mm.
Circumference of base		475 mm.
Distance between tips of cores	ca.	1720 mm.

SARASOTA COUNTY

The activities of Mr. J. E. Moore of Sarasota have revealed a large part of the rich Pleistocene fauna of Sarasota County. Some of this material has been briefly listed,[1] but it remains to consider its bearing on west coast Pleistocene geology in slightly more detail.

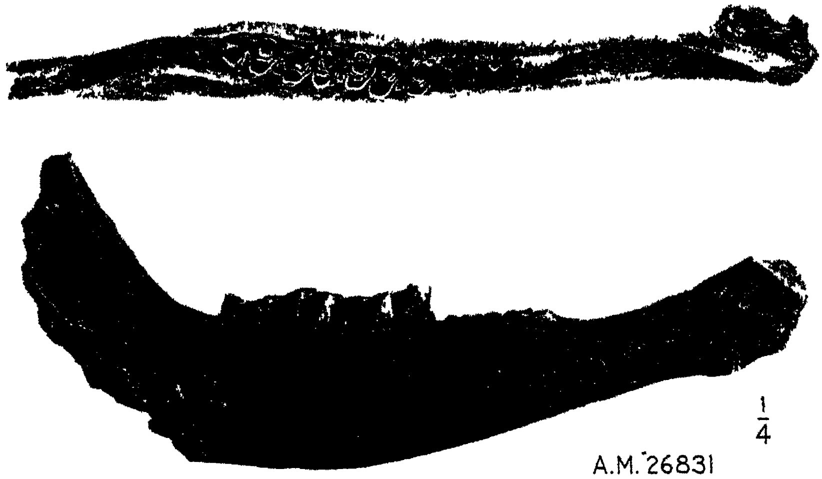

Fig. 7. *Bison latifrons.* Right lower jaw from near Bradenton, superior and external views. A. M. N. H. No. 26831. One-fourth natural size.

The occurrences are of three sorts:

1. Beach Deposits. These deposits, although of recent age, often contain Pleistocene fossils and not infrequently also Tertiary fossils. These have been found at various points from Venice north to Piney Point in Manatee County, and generally consist of horse or shark teeth

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[1] Simpson, 1929. 20th Ann. Rept. Fla. State Geol. Surv., pp. 274–275

(especially *Carcharodon*) and plates of mammoth teeth. They are obviously derived by erosion from older beds and are not of geologic or morphologic importance.

2. Hog Creek. This is a unique deposit at the mouth of Hog Creek, a mile and a half northwest of the Sarasota courthouse. The fossils were all dredged, but Mr. Moore, who followed the operations closely, states that the fossils were derived from a blue clay 8 to 14 inches in thickness and 11 to 12 feet below the present sea level. Below this clay is a solid limestone, and above it a thick gray clay with phosphate pebbles.

The peculiar features of this deposit are (a) its depth, the absolute elevation of the bone layer much lower than elsewhere in this region, (b) the argillaceous rather than sandy nature of the bone stratum and the presence of phosphate in it and in the overburden, (c) the fact that the bone bed lies directly on Miocene limestone, the marine Pleistocene which usually underlies it being absent, and (d) the nature of the fauna, which includes Pliocene as well as Pleistocene species.

All of these peculiarities seem well accounted for by the theory that this is a Pleistocene River deposit, whereas the typical Pleistocene, as in the Seminole Field, was deposited by small streams, in bogs, and by the wind. The incision of the Hog Creek beds below the present or the Pleistocene sea-level was probably due to the scour of an estuary. Phosphate is present because the stream reached into the phosphate areas headward and cut into the Miocene along its course, whereas the smaller streams were shorter and did not cut through the marine Pleistocene, which is generally not phosphatic.

The absence of the marine Pleistocene here may be due either to non-deposition because of the presence of estuarine rather than littoral conditions, or may be due to erosion after the post-marine uplift. Absence of the marine Pleistocene through non-deposition may be seen at several places along the west coast, representing either extensions of the restricted peninsula or islands not covered by the sea. An example probably of the latter sort is seen in the so-called travertine quarry about two miles southeast of the town of Manatee. Here the impure terrestrial Pleistocene sands, with a few fossil bones, rest directly on impure fuller's earth, probably of Miocene age, which in turn rests on phosphatic limestone (the so-called "travertine") surely of Miocene age.

The Hog Creek fauna, as represented by the Moore collection, consists of twenty-three species of Pleistocene land mammals and three apparently Pliocene species (*Hipparion ingenuum, H. plicatile, Serri-*

dentinus sp.). With the exception of these three, the species of land mammals all occur in the unit fauna of Seminole Station A. The Pliocene remains, like some of the phosphate, were surely washed down from an older deposit by the Pleistocene river.

3. Deposits similar to the Seminole Field and Bradenton occurrences. These are the most important numerically and in the variety and perfection of the fossils. Mr. Moore has found fifteen or more localities of this sort for Pleistocene mammals in Sarasota County. They fall into two groups—(1) a series of about a dozen localities east, northeast, and southeast of Sarasota, from near the Manatee County line about four miles northeast of the Sarasota courthouse southward and south southeastward for a distance of about six miles. This includes the faunas from the Fruitville Ditch and Philippi Creek previously listed.[1] The bones occur in sand or sandy clay either immediately above the white marine sand or within a foot or two of it. The fauna is that of Seminole Station A, except that less than half as many species are known. Only one species, *Castoroides ?ohioensis*, has not been found in the Seminole Field.

A second group of localities includes the Parker farm and adjacent region five or six miles east of Venice. Here the common Pleistocene species are all found; mammoth, horse, bison, deer, camel, tapir, glyptodont, and others. In place in a soft white sand along a canal the following typical but limited fauna was found in a small pocket by Moore and Sorensen:

Equus leidyi
Equus littoralis
Tanupolama mirifica
Bison latifrons

Near this locality are a few shells apparently in place above the bone level—inconclusive but suggestive evidence of a subsidence following the post-Anastasia uplift.

A NEW RECORD

F.S.G.S. V1539, a very small jaw from Stratum No. 2 (Melbourne Beds) at Vero proves to belong to *Reithrodontomys humulis*. This tiny harvest mouse is still present in Florida, but neither the species nor the genus has hitherto been reported in the Pleistocene.

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[1] 20th Ann. Rept. Fla. State Geol. Surv., p. 275.

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NEW MESOZOIC AND CENOZOIC FORMATIONS ENCOUNTERED BY THE CENTRAL ASIATIC EXPEDTIONS IN 1928[1]

BY L. ERSKINE SPOCK

INTRODUCTION

In the course of the exploration of 1928, the Central Asiatic Expedition made two extended traverses into country not hitherto examined by them. On both of these traverses new members of the Gobi[2] or "later" sediments were discovered. The first traverse, undertaken early in the season, extends westward from the Shara Murun District, passing in a southwesterly direction to Pailing Miao and thence westward along the caravan route which leads to Sinkiang, Hami and Urumchi, one of the main thoroughfares of trade of the Central Asian plateaus. This is the desert road to Turkestan. The traverse ends at Go Yoto Gol, a distance of approximately three hundred miles from the Shara Murun.

The later traverses into "new" country occupied parts of the months of June, July and August. The ground covered at this time is a roughly triangular area extending eastward from the Kalgan-Urga trail, in the general latitude of Iren Dabasu and Irdin Manha. The lake district centering about Ungur Tsagan Nor marks the eastern limit of this series of traverses.

The formations encountered which are of sufficient stratigraphic or structural importance to receive names are listed below. Unfortunately the scarcity of diagnostic fossil remains renders it impossible to place the formations of Cretaceous age in certain stratigraphic order. The localities indicated by the formational names are shown in figure 1.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 98.

[2] Granger, Walter, and Berkey, Charles P. 1922. 'Discovery of Cretaceous and Older Tertiary Strata in Mongolia.' Amer. Mus. Novitates, No. 42.

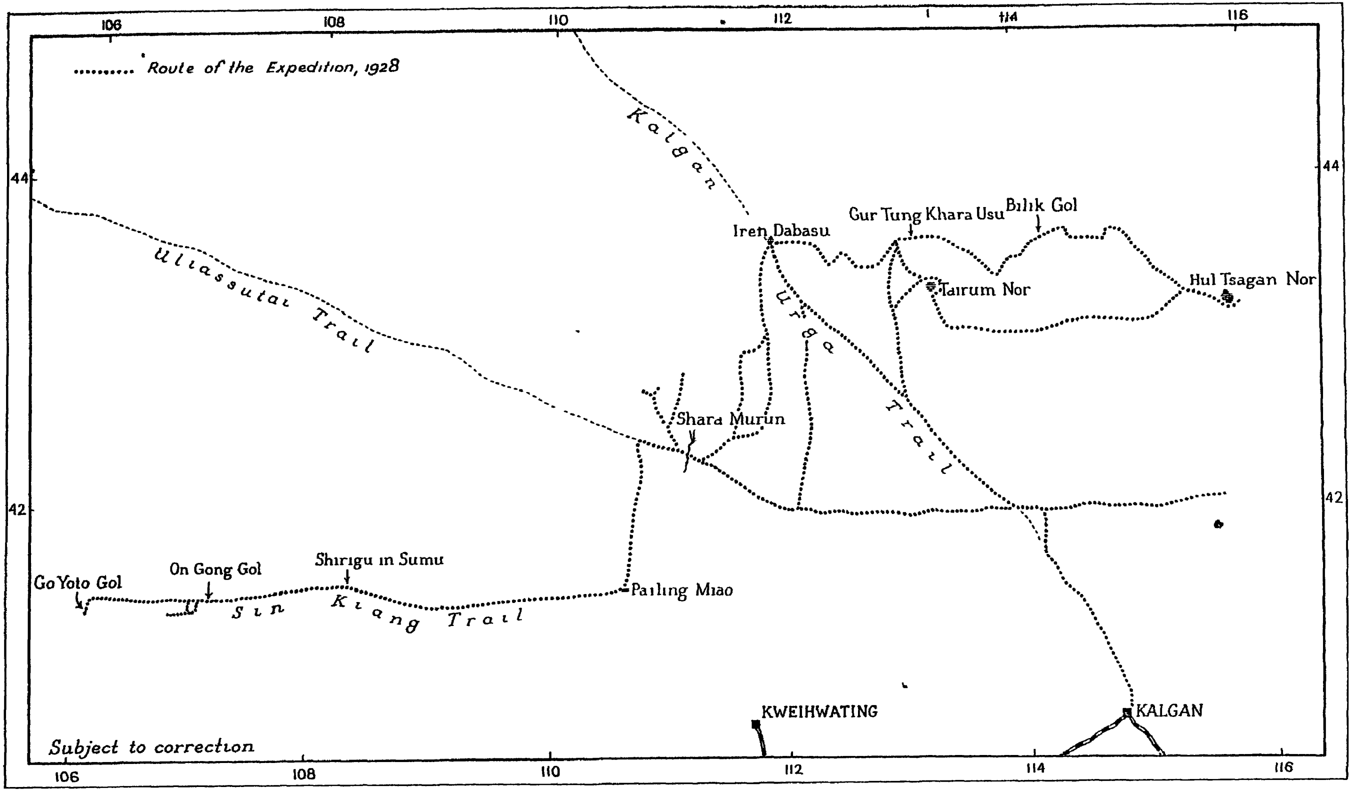

Fig. 1. Sketch map showing the approximate routes taken by the Central Asiatic Expedition in 1928, and the type localities o the formations described in this paper. The map is subject to correction.

Age	Formation	Thickness	Character
Pleistocene	Bilik Gol	10–25	Sands with interbedded soil
Pliocene	Tung Gur	±500	Sands, clays, gravels; lacustrine limestones
Cretaceous	Shirigu	?	Red and gray clays and sands
	On Gong	±300	Red silts, sands and gravels
	?Go Yoto	±250	Brick-colored silts
	Tairum Nor	8–60	Clays, silts and coarse sands.

The Tung Gur and Tairum Nor formations belong definitely to the sediments of the Iren Gobi[1], the structural downwarp centering about Iren Dabasu as its lowest point. In this basin, sediments of the Gobi series extend with only local interruptions from Ula Usu on the west to beyond Hul Tsagan Nor on the east. The remaining Cretaceous formations lie to the west along the Sinkiang trail, in little-known country where the geomorphologic history of later times has been complicated by volcanism and more or less violent diastrophic disturbances. All the formations listed above lie within the limits of Inner Mongolia.

TAIRUM NOR FORMATION

On the southern and southwestern edges of the Tairum Nor depression, strata of Cretaceous age occur at two separated localities. Although fossils have been found at only one of these, the beds at the two places are lithologically similar, and there is little doubt as to their identity. In the eastern locality (Fig. 2), the beds lie horizontal and undisturbed on the peneplaned surface of the ancient floor. The basement consists of a complete series of highly deformed graywackes and quartzites, interbedded with sheared igneous rocks and intruded by granite. The Tairum Nor strata are made up of red and gray clays, fairly well bedded and frequently containing many small rounded pebbles. Only about ten feet of the formation remains of the eastern locality, and this remnant is fast being removed by wind erosion, which is rapidly clearing the basin floor and adding the débris to the wide expanse of drifting sand which covers the desert to the south and east. To the north the strata thin out and disappear; to the south they terminate abruptly against a scarp of ancient limestone. Only fragmentary fossils were collected from these beds, but the presence of a small carnivorous dinosaur is sufficient to indicate the Cretaceous age of the formation.

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[1] Spock, L. Erskine. 1929. 'Pliocene Beds of the Iren Gobi,' Amer. Mus. Novitates, No. 394.

Farther to the west the same strata occur on the edge of the depression, faulted down against the ancient rocks and dipping westward toward the playa from which the Tairum Nor formation takes its name. The beds themselves are also cut by a steeply dipping fault, along which a dike has been intruded. The lithology of the beds is identical with those of the eastern locality, but although a greater thickness is exposed no fossils were found in them.

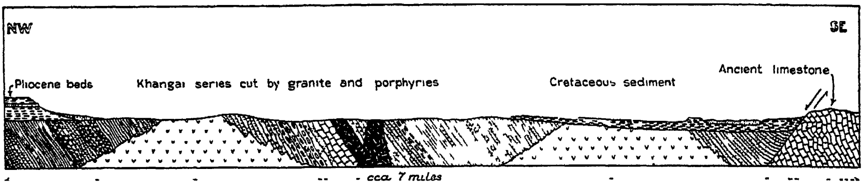

Fig. 2. Section across the Tairum Nor depression.

Not far from this place is a third locality where rocks of seeming Cretaceous age are exposed, but their lithology is somewhat different from the beds described above and they contain no fossils except a few fragments of plants. They are grouped here tentatively with the Tairum Nor formation, solely because their lithology and structural condition seems to preclude them from being included with either the older or younger formations of the region.

GO YOTO FORMATION

At the extreme western end of the Expedition's traverse along the Sinkiang trail, there is a large structural downwarp[1] in the ancient rocks which comprise the pre-Cretaceous[2] floor of the Gobi Desert. This basin lies some three hundred miles west of the Shara Murun, to the north and west of the Khara Narin Ola and the great northern arc of the Hwang Ho, at about Lat. 41° 30′ N. and Long. 106° E.[3]

The sediments which formerly filled the basin consist of firmly compacted fine sands of a highly uniform texture. They are packed with small irregular nodules of white clay. No bedding can be distinguished except where there is an occasional streak of pebbles. The color is uniformly a brick red. It is quite probable that this is a wind-laid sandstone of a type similar to the Djadochta formation of Outer Mongolia, although there is no suggestion of eolian cross-bedding. Erosion has removed the greater part of the sediments, carving the formation into a series of isolated mesas which are separated from each other by wide stretches of loose, drifting sands. Here and there inliers of the metamorphic pre-Cretaceous floor have been exposed by the complete removal of the sediments. Fig. 4 illustrates a hill of phyllite which no doubt is a resurrected monadnock of the pre-Cretaceous peneplane. The sediments are planed off by an almost perfect erosion surface, interrupted at one point by a nearly vertical chimney of sandstone which rises sixty feet above the mesa level. The total thickness of the Go Yoto exposed at the localities seen is over 200 feet. No fossils were found in the formation, hence its age is problematical. Nevertheless, the consolidation and general character of the material are typical of the Cretaceous deposits of Mongolia. It is not unlikely that a further and more exhaustive examination of the exposures may reveal fossils.

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[1] Berkey, Charles P , and Morris, F. K. 1924. 'Basin Structures in Mongolia.' Bull. Amer Mus. Nat. Hist., LI, pp. 103–127.

[2] Berkey, Charles P., and Morris, F. K. 1924. 'The Peneplanes of Mongolia.' Amer. Mus Novitates, No 136.

[3] The precise positions of the places mentioned in this paper will not be available until the route maps are completed.

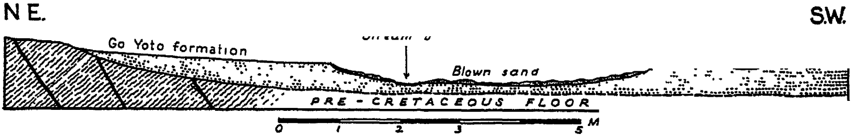

Fig. 3. Section of the northeastern part of the Go Yoto formation.

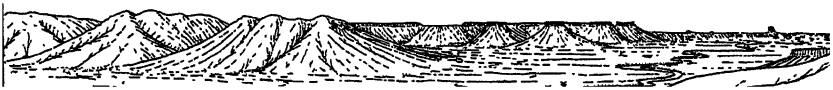

Fig. 4. Sketch of the Go Yoto basin looking southeast. The Go Yoto formation appears as a series of escarpments in the background. The hills to the left are inliers of ancient phyllite.

ON GONG FORMATION

The On Gong formation covers a wide area, the southern side of which is crossed by the Sinkiang trail about fifty miles east of the Go Yoto basin and about 250 miles west of the Shara Murun. Only the southern part of the formation has been examined by the Expedition, but it is possible to see exposures for many miles to the north. The strata were deposited in what originally was a downwarped area of the pre-Cretaceous floor. Subsequently the southern and eastern sides of the basin were arched up in the manner indicated in Fig. 5, with the result that the south central part of the formation now presents an anticlinal structure. In more recent times erosion has removed much of the sediment, revealing areas of the ancient floor At the east side of the basin, the On Gong formation rests upon earlier Mesozoic sandstones interbedded with basalts; to the west and south the underlying rocks consist of schists, gneisses and granites, while to the north the removal of Cretaceous rocks has revealed a series of phyllites and graywackes.

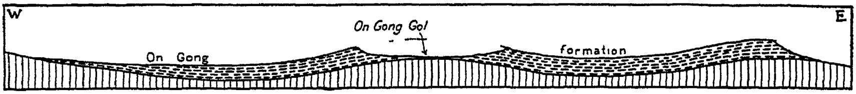

Fig. 5. Section through the southern part of the On Gong formation to show the deformation of the Cretaceous strata.

The sediments consist of bedded sands and clays with intercalated lenses of coarse, well-rounded gravel. The color is a deep red, except for a few thin layers of white clay. The beds are but slightly consolidated. The total thickness of the formation is about 400 feet in the southern part of the basin, but probably increases somewhat to the north. Fossils are very rare in the sections examined. The specimens obtained consist of a few fragments of turtle and possibly small predentate dinosaurs and a few characteristic parts of a large *Diplodocus*-like sauropod.

The formation is probably the approximate equivalent of the Oshih and Ondai Sair formations of Outer Mongolia.

SHIRIGU FORMATION

This formation takes its name from the deserted lamasery of Shirigu-in-Sumu, which lies a short distance north of the caravan trail, east of the On Gong basin and about 46 miles west of the Chinese yamen, Hei Ni Ho. The sediments are red and white clays and sands interbedded with flows of vesicular and amygdaloidal basalt. In the exposures examined, the lava flows attain a thickness considerably greater than the sedimentary layers. Under the extensive plain which spreads out for many square miles south of the lamasery, the sediments lie almost horizontal and are planed off by a well developed erosion surface. The few exposures which can be found on the plain occur where dry stream channels have cut down into the sediments. Over nearly all its area the plain is covered by sheets of drifting and semi-anchored sand. To the north of the plain the sediments and lavas have been dislocated by an east-west fault. As a result a great block has been raised above the plain and tilted to the north. Immediately north of the lamasery the fault scarp is approximately 400 feet high. Its surface slopes northward some 40 or 50 feet per mile. Dissection is rapidly destroying the uplifted erosion surface. Along the south-facing fault scarp the strata are well exposed. They may also be seen in the ridge produced by the drag of the layers on the downthrow side of the fault. A careful examination of the sediments proved them to be very poor in fossils; nevertheless enough fragmentary remains were found to justify dating the formation as Cretaceous.

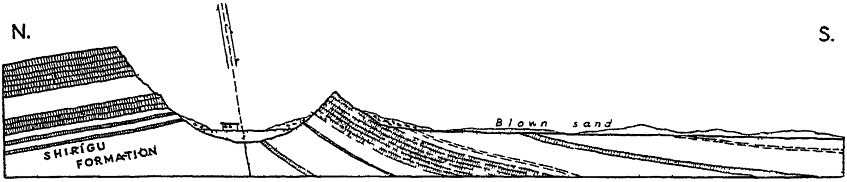

Fig. 6. Generalized section at Shirigu-in-Sumu showing the fault-block structure.

TUNG GUR FORMATION

The Tung Gur formation has received a brief description in an earlier preliminary paper.[1] This formation is the most extensive of all the "later" formations so far discovered in Inner Mongolia. In the future it may be necessary to subdivide the Tung Gur into several different formations; at the present time the term is loosely used to denote all the Pliocene strata which lie to the east and north of P'ang Kiang and the Kalgan-Urga trail. The eastern border of the Pliocene beds of Inner Mongolia has not yet been reached and it is possible that these strata are continuous into the region of Dalai Nor.[2] The Tung Gur formation consists of a series of fluvial and lacustrine strata of various lithologic types. In certain somewhat restricted localities abundant fossils occur, but over most of the region the beds are barren. A further study of the Tung Gur formation is of the utmost importance, and promises a rich reward in the fields of palæontology, stratigraphy, and areal geology.

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[1] Spock, L. Erskine. 1929. 'Pliocene Beds of the Iren Gobi,' Amer. Mus. Novitates. No. 394.

[2] Teilhard de Chardin, P. 1926. 'Etude Géologique sur la région du Dalai-Nor.' Mém. de la Soc. Géol. de France, No. 7.

BILIK GOL FORMATION

Bilik Gol is a small intermittent stream which lies about half a mile south of the ornate lamasery of Pailing-in-Sumu. It is about forty miles east of Gur Tung Khara Usu. The country rock of the region consists of schists and slates which have been invaded by large intrusions of granite and minor intrusions of many igneous types. The Pleistocene beds occur as filling in a fairly large valley that was eroded in the granite. Presumably the climate at the time when the beds were deposited was different from that of the present time, since the modern stream is engaged in re-excavating the valley and removing the Pleistocene sediments. The material consists for the most part of light-colored (white, yellow, orange and gray) sands. The sand layers are interrupted by a layer of black rich-looking soil which is from four to six feet thick. The outer granite walls, the Pleistocene fill and the bottom of the temporary stream channels are all more or less covered by sheets of sand, which is partly anchored by sparse vegetation, and partly in transit with the wind.

Below the soil layer there occur two species of aquatic gastropods, neither of which has yet been identified: a small closely coiled form and a larger form with a sharply conical spire. The remains of vertebrate animals collected were of a fragmentary nature. According to Mr. Granger's field identification they consisted of the "distal end of the humerus of an artiodactyl similar to an elk, the horn of a gazelle-like animal and fragments of undetermined artiodactyls."

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DESCRIPTION OF A NEW SPECIES OF *NEUSTICURUS* FROM SOUTH AMERICA (LIZARDS, TEIIDÆ)[1]

BY D. T. SINITSIN

While at The American Museum of Natural History, in 1927, I had the opportunity to examine the lizards of the family Teiidæ in the collection there. As a result of this study, I have presented, elsewhere,[2] my conclusions pertaining to the phylogeny of this interesting and important South American group, reserving for the present article the diagnosis of a new species of *Neusticurus*.

Neusticurus ocellatus, new species

TYPE SPECIMEN.—A. M. N. H. No. 22512; Rurrenabaque, Bolivia; collected by N. E. Pearson of the Mulford Biological Expedition in October, 1921; a male.

DISTRIBUTION.—Western Bolivia and southern and central Peru.

DIAGNOSIS.—A species closely allied to *N. ecpleopus* Cope of northern Peru and southern Ecuador, differing in the possession of lateral scales which are not essentially different from the dorsals; back and sides covered by enlarged plates with high keels, these surrounded by granules and arranged in rather regular transverse series; caudal ridges distinct above, the median two apparently closer together than they are in other forms of *Neusticurus;* frontonasal entire, but with a short median suture often present anteriorly; four supraoculars; a series of 21 femoral pores on each thigh in the male (type), this reduced to only a few preanal pores in the female; uniform brownish above and below, lighter beneath; a series of white, black-edged ocelli usually present on the sides.

MEASUREMENTS OF THE TYPE SPECIMEN.—Total length, 210 mm.; tip of snout to vent, 76 mm; tip of snout to ear, 19 mm.; width of head, 14 mm.; front leg, 26 mm.; and hind leg, 37 mm.

PARATYPES.—Fifty-four specimens from Chanchamayo and Perené, Peru.

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[1] Revised by Charles E. Burt, who will further discuss the new form in his forthcoming report on the South American lizards in the collection of The American Museum of Natural History.

[2] 1928, Zool. Anz., LXXVI, pp. 222–236.

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CANTHONELLA, A NEW GENUS OF SCARABÆIDÆ (COLEOPTERA)

BY EDWARD A. CHAPIN

CANTHONELLA, new genus

Related to *Canthon* Hoffmansegg but differing from that genus in having the pronotum margined basally as well as laterally, in the complete effacement of the posterior angles of the pronotum, and in having each tarsal claw furnished with a conspicuous submedian tooth.

Clypeus bidentate, the teeth small and separated by a broad semicircular notch. Superior portion of eye moderate in size but smaller than inferior portion. Antenna nine-segmented. Terminal segment of maxillary palp long, cylindro-acuminate. Pronotum with marginal bead both laterally and basally and with posterior angles obliterated. Prothoracic pleuræ with transverse carina. Scutellum not visible. Elytra coarsely and deeply striate, the intervals strongly convex. Elytral epipleuræ narrow, of even width nearly to apex, where they taper off sharply. Anterior tibia very gradually dilated toward apex, minutely serrulate along external margin, outer apical angle spiniform; lateral teeth two in number, small and well separated; spur slender, curved, about thrice as long as either lateral tooth. Anterior tarsus present. Middle and posterior tibiæ slender, curved, not dilated apically, each with a single spur. Each claw furnished with a submedian tooth.

GENOTYPE.—*Canthonella parva*, new species.

In the conformation of the head the present genus resembles *Cassolus* Sharp but it is not probable that the two are very closely related. The sharply delimited antennal cavities beneath the anterior angles of the pronotum recall certain species of *Canthon* Hoffmansegg, notably those associated with the name *Pseudocanthon* Bates. However, the margined pronotum, the deeply grooved elytra, and the toothed tarsal claws serve to separate *Canthonella* from all of the genera of canthonides known to me.

Canthonella parva, new species

Black, elytra each with a yellowish-white, quadrangular spot on the humerus reaching from the third stria to the margin, antennæ (except clubs), palpi and tarsi castaneous. Head finely and moderately densely punctured, the punctures coarser on the vertex. Pronotum coarsely, closely and evenly punctured. Elytra each with seven deep striæ, all of which are free basally and joined apically. Interspaces strongly convex and of unequal lengths; the first (sutural) and second reaching almost to the apical margin, the third a little shorter, the fourth much shorter, the fifth a little longer than the fourth, the sixth and seventh again shorter. Epipleural carina ends just back of the third interspace. Metasternum sparsely punctured, the punctures coarser laterally. Each abdominal segment with a single row of coarse punctures. Pygidium coarsely and sparsely punctured laterally, the median area finely and sinuately strigillate. Length, 3 mm.

TYPE.—A male from Coamo Springs, Porto Rico, June 5–7, 1915.

PARATYPES.—Two specimens from same locality, same date; one female from Adjuntas, Porto Rico, June 8–13, 1915.

Type, No. 28456, and Adjuntas paratype, No. 28547, in the collection of The American Museum of Natural History; Coamo Springs paratypes in the United States National Museum, Cat. No. 42804. They were collected by F. E. Lutz and A. J. Mutchler in sifting fallen leaves.

Compared with *Canthon pygmæus* Harold, described from Cuba, the present species is not "piceus et subænescens" but is an almost blue-black, the pale spot on the elytron is not basal but humeral, and the pronotum is not "obsolete at dense punctulato" but strongly, densely and moderately coarsely punctate. It is evident, however, that Harold's species should be known as *Canthonella pygmæa* (Harold).

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BOVIDÆ FROM THE ASIATIC EXPEDITIONS[1]

BY GLOVER M. ALLEN

The Bovidæ of Mongolia and China offer some interesting contrasts. In the open Gobi Desert, two genera of gazelles occur, apparently as invaders of this region from the high plateaus of Tibet and the country to the southwest, while in the mountainous parts of Mongolia are found the ibex and the argali, the latter no doubt having formerly had a much more extensive range to the eastward, since it still occurs north of Peking and is known from Shantung as a subfossil. The ibex, however, seems to find its eastward limit in the mountains of the central Gobi, and has its general area of distribution to the southwest. In contrast to these species of open, arid country are the serows, gorals, and takins of the wooded cliffs and mountain thickets of China, species more characteristic of southeastern Asia. In the course of several years' work, the Asiatic Expeditions, under the leadership of Dr. Roy Chapman Andrews, have amassed a magnificent series of skins and skulls representing nearly 175 specimens of this group, a brief report on which is here given.

Ovis ammon darvini Przewalski

Ovis darvini PRZEWALSKI, 1884, 'Reise in Tibet,' p. 268, Fig.

The discrimination of the local races of argali is still in a far from satisfactory state, nor can it be said that the elaborate monograph (in Russian) by Nasonov (1923) has altogether cleared the matter. Although Pousargues (1898) recognizes no subspecies of this sheep, later authors seem agreed that the argali of Mongolia and North China differs racially from typical *Ovis ammon* Linné (type-locality, upper Irtisch River, Siberian Altai). Lydekker, in his key (1913), gives as the chief distinguishing character the less-developed horns of the Mongolian argali, ranging from 41 to 50.5 inches in length of curve, while in typical *ammon* they form more than a complete circle, and attain a length of from 59 to 62 inches. Howell (1929) believes that the eastern race may be distinguished by the dingy rather than pure-white rump patch.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 99.

Various technical names have been applied to this eastern race. Severtzov, in 1873, called it *Ovis argali mongolica*, while Peters three years later, unaware of this author's work, renamed it *Ovis jubata*, type-locality the eastern part of Mongolia north of Peking. Both of these names, however, had been previously used for domestic races of sheep so that Hollister, in 1919, replaced Peters's name by *Ovis comosa*. Meanwhile, in 1913, Nasonov had described as *Ovis kozlovi* the sheep of southern Gobi (type from Yabarai Mts.) and in his 1923 monograph made this a race of *O. ammon*. He likewise regarded as distinct races the sheep of the Khur-khu Mountains, central Gobi, named *O. darvini* by Przewalski in 1884, and the sheep of the Sailüghem and Kobdo River basin of western Mongolia, which he named *O. przevalskii*. This last, however, Sushkin (1925), in reviewing his paper, regards as doubtless synonymous with *O. ammon*.

The series of over twenty sheep collected by the American Museum's expeditions includes five from Artsa Bogdo, at no great distance from the type-locality of *darvini*, and nine from Kweihuacheng, Shansi, as well as a single one from Lao Tsa Tao, Chihli Province, one hundred miles north of Peking, and another from the Tai Pei Shan, Tsingling Mountains, Shensi, the last apparently a new locality for sheep in China. I have carefully compared this series and can find no differences that would possibly be of value in distinguishing the sheep from these various localities, so they must all be regarded as representing one race, for which the oldest available name is *darvini*. It may be said, however, that the specimen from the Tai Pei Shan has the belly broadly and sharply white as far forward as the middle of the chest, whereas all but one or two of the Kweihuacheng series are dull-bellied or grizzled forward of the inguinal region. A single summer skin from the Little Altai, near Turkuta Pass, is available for comparison and is taken to represent typical *O. ammon*. It is rather darker than summer skins from the Gobi, and quite without trace of the rump patch, the entire buttocks and the belly being dark yellowish brown, frosted with whitish. In summer skins of *O. a. darvini*, the pale area of the buttocks is not sharply marked off but grades insensibly into the yellowish brown of the haunches. There is possibly a slight darkening with age.

Pseudois nayaur szechuanensis Rothschild

Pseudois nahoor szechuanensis Rothschild, 1922, Ann. Mag. Nat. Hist., (9) X, p. 231.

The bharal of northwestern China seems to differ from the typical form of the Tibetan frontier of Nepal in the browner rather than blackish-gray summer coat, and in the restriction of the lateral stripe to the middle of the flanks. The leg markings are similar in general to those of the ibex, but nearly black. The stripe on the foreleg is interrupted at the knee, and extends quite to the hoofs, with lateral branches to the dew-claws.

Lydekker, in 1913, suggested that the Chinese blue sheep would be found to differ from the Tibetan animal, and this has proved to be the case, for Rothschild nearly ten years later named it on the basis of a skull from Shensi and a mounted skin from Szechwan. Later, 1928, Howell also pointed out the racial differences, and bestowed upon the northern animal the name *P. nayaur cæsia*, type from near Archuen, Kansu, which becomes a synonym. The Asiatic Expeditions secured an adult pair and an immature female from the same region, which appear to bear out the points of distinction noted by these authors. The horns of the male form a lateral curve; those of the female are smaller and nearly erect.

Capra sibirica sibirica Meyer

Capra sibirica MEYER, 1794, Zool. Annalen, I, p. 397.

The type-locality of *Capra sibirica*, based on Pallas's description, is the Sayansk Mountains, west of Lake Baikal. A series of eighteen ibex skins in summer pelage collected by Dr. Andrews at Artsa Bogdo, in the central Gobi region, is regarded as representing this animal, which, like the argali, has penetrated the central part of the Gobi by following the mountainous country probably from the northwest. Adult males are yellowish brown above, fading on the sides to pale ochraceous, and to buff on the chest, and white on the belly. A narrow black line extends from the occiput nearly to the base of the tail, the tip of which is blackish brown; an area in front of the eyes extending transversely across the bridge of the muzzle is more or less dark brown like the beard; while the entire front of the neck and center of the chest may be more or less ticked with blackish brown; there is a dark stripe of blackish brown down the entire front side of the legs from the upper arm and the groin to the hoofs. In younger animals, the blackish ticking is absent, the black dorsal stripe often so, and the dark foot stripe is commonly interrupted just above the knee (or the hock), and again above the inner dew-claw.

In recent years a number of races of this ibex have been described, but Lydekker in his 'Catalogue of Ungulate Mammals of the British Museum,' does not attempt to appraise these. It is quite probable that the race described by Noack as *C. s. hagenbecki*, from Kobdo, in the western Gobi, is inseparable from the animal I here refer to typical *C. sibirica*. The former is based on five skins in late winter pelage from "Ektag bei Kobdo," which are said to differ in color from three others from near Bjelucha in the central Altai to the westward, regarded as typical *sibirica*, though taken even farther from the type-locality. It seems very questionable if there can be as many well-marked local races as supposed.

In the series from Artsa Bogdo, it is evident that the males become darker with age, especially on the throat and chest. In the summer pelage there is no distinct saddle-patch as described by Lydekker, but the coloring grades by insensible degrees from the dark brown of the median area to the more ochraceous sides, paler flanks and whitish belly. The longer winter pelage is evidently very much more whitish as described and figured in color by Lorenz (Denkschr. Akad. Wiss. Wien, 1906, LXXX, p. 83, Pls. I–II). The slightly larger size and longer beard, as compared with the ibex of the European Alps, seem to be differences of degree rather than of kind, so that possibly the Asiatic animal may eventually be regarded as a subspecies of it.

Capricornis sumatraensis argyrochætes Heude

Capricornis argyrochætes HEUDE, 1888, Mém. Hist. Nat. de l'Emp. Chinois, II, p. 4, footnote.

Characterized by its goat-like form, with horns curving backward. Color blackish brown, the feet rufous, usually with a line of blackish from below the knee to the hoof; hind foot usually clear rufous without dark line in front; white throat patch usually well developed, lips and a line from angle of mouth backward, white; sides of muzzle dark brown; mane more or less whitish.

The type-locality is the mountains of Chekiang, hence four specimens in the collection from Tunglu and Mokanshan of that province may be taken as typical. I can find no differences of moment that would distinguish these from a series of skins and skulls from Fukien and eastern Szechwan, but in their duller, browner coat, the lack of a contrasting patch of tan on the sides of the muzzle, and in the usual presence of considerable whitish in the mane, they seem to differ from skins of the western Szechwan animal representing *milne-edwardsi*, though the skulls of the two do not show appreciable characters that would separate them. One of the Chekiang skins has the body, legs, and feet deep black throughout.

Capricornis sumatraensis milne-edwardsii David

Capricornis milne-edwardsii David, 1869, Nouv. Arch. Mus. d'Hist. Nat., Paris, V, Bull., p. 10.

Characterized by the slightly more intense coloring, deep black of the body, usual lack of much white in the mane, and the presence of a tan-colored spot on either side of the muzzle.

This was the first race of the serow to be described from China. It was collected in Moupin, a part of central Szechwan, by Père David, who briefly diagnosed it, and it was later more fully described and figured by Milne-Edwards. Though it is apparently not very different from the later-described white-maned *C. argyrochætes* of eastern China, it seems to be more intensely colored, with a bright-tan nose spot and a dark mane. The skulls of the two, when a sufficient series is examined, present the same variations. Some have narrow nasals, squarely truncate behind, and others have them very much broader and in contact not only with the entire dorsal edge of the maxillary but with the dorsal process of the premaxillary as well. Lydekker regards specimens from Yunnan and Burma as representing the same form, and mentions skins in the British Museum from Si-ho Valley, western Szechwan, and from north of Moulmein, Burma. After careful examination of the type specimen, I am convinced that *C. osborni* Andrews, from near Teng-yueh, Yunnan, must be regarded as a synonym.

Père Heude has given names to a number of specimens, chiefly from Moupin, showing slight variations in tooth structure or in the proportionate size of the nasals, but, for those who do not share his concept of a species, these names must be regarded as synonyms of *milne-edwardsii*, originally described from the same area.

Capricornis sumatraensis montinus, new subspecies

Type.—Adult male, skin and skull, No. 43039, American Museum of Natural History, from the Lichiang Range, Snow Mountain, Yunnan Province, November 5, 1916. Roy C. Andrews, collector.

Description.—Similar to *C. s. milne-edwardsii* but with feet whitish or rufous, usually without a black median line; skull characterized by the shallowness of the notches at the rear edge of the palate and by the greater width and more flaring shape of the posterior narial opening.

Color blackish brown, the body hairs in general pale or whitish basally, becoming blackish in the terminal half. Side of muzzle with a poorly defined patch of dull ochraceous just back of the tip; lips white with a white line extending back some four inches from corner of mouth, and separated by a narrow blackish area from the white throat patch that extends forward between the rami of the jaws; backs of ears and area about their bases more or less tawny, mixed with darker which predominates on the terminal third of the ears; inside of ears white. The long hairs forming the central part of the mane are chiefly whitish becoming brown at their tips. Both fore and hind feet may be whitish with a slight admixture of pale rusty, more intense in some specimens. In the type the fore feet are bright clear ferruginous, the hind feet with an indication of the blackish stripe; again the dark central line may be practically obsolete. Along the sides and especially about the buttocks there is more or less mixture of rusty hairs; the belly and inguinal region are whitish.

Skull.—The distinctive features of the skull in comparison with the two races previously mentioned are: (1) the wider, more flaring walls of the posterior narial opening correlated perhaps with the high altitude at which the animal lives; (2) the much shallower lateral notches of the posterior border of the palate, so that if a straight edge be laid across the hinder border of the last upper molars the palatal notches do not extend anterior to it, whereas in the two other races they extend forward to the level of the middle of the last tooth.

Measurements.—The field measurements of the type are recorded as: total length, 1620 mm.; tail, 80 mm.; hind foot, 400; ear, 190. The skull measures: condylobasal length, 295 mm.; basal length, 279; palatal length, 172; length of nasals, 98; combined width of same, 51; zygomatic width, 129; mastoid width, 91; width across upper molars, 87; width of posterior nares, 44; upper cheek teeth, 84; lower cheek teeth, 98.

Isolated on the great snow peaks of the Lichiang range, the serow of this area appears to have developed distinguishing peculiarities of the palate and posterior narial region correlated perhaps with the need of a wider air passage for breathing in the rarefied atmosphere at altitudes of 10,000 feet and over in its alpine habitat. The nearly white feet distinguish some skins at hand from those of the two races previously mentioned, but, as already noticed by Andrews, this color may vary to bright rusty, and in one skin there is a short black stripe on the front. A vivid account of hunting serows in this mountain region has been published by Dr. Andrews.

Næmorhedus goral caudatus (Milne-Edwards)

Antilope caudata A. Milne-Edwards, 1867, Ann. des Sci. Nat., Zool., (5) VII, p. 377.

There can be no doubt that the gorals of China and northeastern India (Sikhim and Nepal) comprise but a single species characterized by its goat-like form, short conical horns more or less in the plane of the face, the absence of lacrymal pits, and the shaggy gray coat with pale throat. There is great individual variation in the amount of brown mixed with the gray, in the tint and extent of the pale throat patch, and in the amount of gray hair at the base of the tail, as well as in the intensity of the ochraceous tint of the feet, factors which render difficult the satisfactory definition of geographic races. No less than eighteen "species" have been recognized by Heude in China alone, while Pocock regards the brown and the gray forms of Nepal as distinct. He also concludes that the animal found in parts of western China is indistinguishable from that of Amurland named *raddeanus* by Heude Finally, J. E. Gray, in 1862, named the Formosa goral *swinhoii*. Lydekker, in his 'Catalogue of the Ungulate Mammals of the British Museum,' 1913, has followed Pocock in recognizing five "species "

The oldest name given to the group is *Antilope goral* of Hardwicke, 1825, which, as Pocock has shown, applies to the gray Himalayan animal. The first name given to any Chinese goral is *A. caudata*, of Milne-Edwards; type-locality, the mountains north of Peking. The same author, in 1871, characterized as new, *Nemorhedus griseus* of Moupin, Szechwan, and three years later *A. cinerea*, a somewhat grayer animal, from the same general region. In 1894, Heude gave names to no less than fourteen Chinese forms which, according to his concept of species, he regarded as new. One of these names, *Kemas henryanus*, had previously been quoted in print by Henry who, apparently, since he mentioned the size of the animal, must stand as its author. The relationship of *swinhoii* of Formosa must be very close to the continental goral.

The collections of the Asiatic Expeditions include over thirty skins from North China and Yunnan, which with a series of seven from Hupeh and Szechwan in the Museum of Comparative Zoology have formed the basis of a careful study. This material seems to include but three recognizable forms: (1) that of North China which averages slightly paler, with a longer under-wool in the winter pelage, and with the gray of the back extending well on to the base of the tail; (2) that of the western highlands, Szechwan and Yunnan, of shorter coat, and slightly darker pelage; and (3) the animal of southeastern China, with darker neck and a smaller but brighter-orange throat patch. The collections contain three skins from Tungling, Chihli Province, that are virtual topotypes of *caudatus*, and two others in fresh, winter pelage from Kweihuacheng, Shansi Province, that are indistinguishable. Two of the Tungling skins illustrate the extremes of color variation, the one a uniform pale buffy gray on the body only slightly darkened by the short blackish tips to the guard hairs, the other much darker and browner in general appearance due to the more abundant dark brown over-hairs with longer brown tips. The woolly under-hairs are gray and nearly as long as the guard hairs. In the grayer specimen the front of the fore and hind feet is nearly whitish slightly washed with buffy, but in the browner animal these parts are almost ferruginous. In the former the forehead, chin, and lower throat are grizzled like the back, but in the latter these areas are dark brown. Both have the usual dark spinal stripe. The four other skins from Chihli and Shansi more nearly resemble the grayer individual. Milne-Edwards believed the tail was longer than in the Himalayan goral, but this character seems variable. The base of the tail, in unworn skins, is mixed gray like the back. The throat in all is nearly clear white narrowly bordered with pale ochraceous.

Næmorhedus goral griseus (Milne-Edwards)

Nemorhedus griseus Milne-Edwards, 1871, Nouv. Arch. Mus. d'Hist. Nat. Paris, VII, Bull., p. 93. Moupin.

The goral of the western Chinese highlands is very little different from *caudatus* of North China. The main external characters are the slightly shorter coat in winter, with shorter under fur, and the somewhat darker, less gray color. But these differences are average ones only. In the specimens at hand, including some twenty skins from Teng-yueh and the Lichiang Range, Yunnan, the throat patch is uniformly whitish with narrow, pale-ochraceous border and extends nearly to the lips; the chin is dusky, the flanks and belly pale buffy gray. The base of the tail is usually dark brown instead of being gray like the back. The length of the tail as measured in the flesh varies from 130–150 mm., and does not differ in this respect from that of *caudatus,* which Milne-Edwards believed was longer. The chief differences observable in the skull are the slightly smaller tooth rows and shorter, finer muzzle as compared with the latter. Indeed, the two animals are so nearly alike that Lydekker refers a skin from Szechwan to *caudatus* and three others from "western China" to *raddeanus* of Amurland.

Næmorhedus goral henryanus (Henry)

Kemas henryanus Henry, Proc. Zoöl. Soc. London, 1890, p. 93; Heude. Mém. Hist. Nat. de l'Emp. Chinois, II, p. 244. Ichang gorges.

A series of six skins and skulls from Hupeh Province, in the Museum of Comparative Zoölogy, indicates that the goral of southeastern China is a recognizable race, to which the name *henryanus* is applicable. The dark brown tone of the body extends to the sides, belly, chin and lower throat, where it encroaches considerably on the throat patch as compared with *griseus* and *caudatus.* The throat itself in all the Hupeh specimens examined is uniformly pale orange instead of whitish with ochraceous border, and Heude states that a similar condition is found in the specimens from Chekiang which he named *arnouxianus.* No doubt there is some degree of variation in the color, for Heude describes his specimen of *henryanus* as having the throat patch white, "bien bordé de jaune," but at the same time names other specimens also from the Ichang gorges, characterized by having the throat patch "moins étendu, mais plus brillant," which seems to be in general true of animals of this part of China. His *K. aldridgeanus* and *K. fantozatianus* are therefore synonyms of *henryanus*.

To this same race appears to belong an imperfect skin (lacking head and feet) secured by the Third Asiatic Expedition at Yenping, Fukien Province. It is in winter pelage (late March), of a rich dark shade, due to the abundance of blackish-tipped hairs over the body. Only a portion of the throat patch is present, but this, though bordered with deep ochraceus, is whiter in the center than in most of the skins from Hupeh. The knees and hocks show the beginning of a deep ochraceous area on the feet. In its darker color and richer ochraceous tones it agrees with *henryanus* rather than with *griseus*. This is the first record I have found for the goral in southeastern China.

Budorcas taxicolor bedfordi Thomas

Budorcas bedfordi THOMAS, 1911, Abstr. Proc. Zoöl. Soc. London, p. 27.

The takin of Tai Pei Shan, Shensi Province, represents the extreme of the paling out of color seen already in *B. t. tibetanus* of Szechwan. The collections of the Asiatic Expeditions include four adult females and an immature animal, all from the type-locality. The former agree in being nearly uniform white with a faint golden tint, most pronounced on the neck and chest, while on the metapodial region and especially on the tail it deepens to rusty. The muzzle may retain a few black hairs and a few longer ones are present just below the eye. In *B. t. tibetanus* the muzzle is blackish and there is a well-defined though irregularly broken eye-ring of blackish, while the flanks retain more or less of darker color, and a black median line runs down the back. It is interesting that a single immature female, also from Tai Pei Shan still retains the dark muzzle and backs of the ears as well as a dark dorsal stripe, but it lacks a definite ring about the eye, while the flanks are only slightly gray, the legs mixed gray or blackish and white. It therefore is nearly like the adult of *tibetanus*, but with slightly less of the darker areas. The only available skull of the latter race is hardly different from that of *bedfordi*, except that the premaxillaries, instead of tapering evenly to the end of the muzzle, bow out slightly in their middle, a character that may be merely individual, but is seen also in Lydekker's published figure of the skull.

Procapra gutturosa gutturosa (Pallas)

Antilope gutturosa PALLAS, 'Spic. Zool.,' 1777, part 12, p. 46, Pl. II.

A gazelle, general color above bright ochraceous buff in summer, paling on flanks, cheeks, and haunches to pinkish cinnamon; muzzle above brown; legs ochraceous buff in front becoming brownish on lower half or third; chin and upper throat, belly and inside of limbs white extending up on the buttocks on either side of the base of the tail, to cut off a narrow median line continuous with the brown of the very short stumpy tail.

A series of nearly thirty specimens, old and young, was secured by the Asiatic Expeditions in the Gobi Desert, to the southeast of Urga. Nearly all are adult females, some of which in late June and early July were with young newly born or nearly ready for birth. Perhaps the males herd apart at this season. The skulls of these antelopes are very different from those of the genus *Gazella*, extremely light and thin of bone, long and slender, with pointed tapering nasals, inflated muzzles, and slightly developed lacrymal depression. The audital bullæ are relatively smaller. Externally these antelopes lack the large glandular opening in front of the eye, are without the facial stripes of *Gazella*, and have no tufts of long stiff hairs on the knees. There is no doubt that they are to be distinguished generically from *Gazella*.

There is a certain amount of variation shown in the shape of the terminal lobe of the last lower molar. In some it is very narrow, with its long axis in line with that of the inner cusps, but in others and especially with age and wear it becomes wider transversely and its axis slightly deflected outward. It was mainly on the basis of this outward deflection of the terminal lobe that Hollister described *P. altaica*, from northwestern Mongolia, but it is likely that this will prove to be merely an individiual variation, while the supposed larger molars of this animal are not different in dimensions from those of adults in the present series.

Gazella subgutturosa hillieriana Heude

Gazella hillieriana HEUDE, 1894, Mém. Hist. Nat. de l'Emp. Chinois, II, p. 245, Pl. XXXVI.

Males with lyrate horns, slightly but definitely turned in at the tips, suborbital glands and knee tufts present. General color above, sandy, about "pinkish cinnamon," deepening in tint along the flanks and across the rump to form a darker band bordering the pure white of belly and buttocks. The color of the back passes down the outer side of legs, and is continuous medially as a narrow strip to the base of the tail, dividing the white of the posterior side of the hind-quarters. Tail dark blackish brown, mixed with ochraceous-tipped hairs basally. Muzzle white, the forehead nearly so; the dark facial streaks from the eye forward usually obsolete. Chin and throat white, continuous with the white of the ventral surface.

As a species, this gazelle has an exceedingly wide distribution from the Persian Gulf, north and east into the Gobi Desert. The type-locality of *subgutturosa* is Persia, "probably the Bussora district" (Lydekker and Blaine), but in eastern Turkestan a slightly larger form, *G. s. yarkandensis*, in which the facial stripes are said to be more clearly defined, intervenes, eastward of which the pale, white-faced animal is found. To the Mongolian gazelle Heude has applied two names, *hillieriana* and *mongolica*, both currently regarded as synonyms of *subgutturosa*. Heude mentions no definite localities and makes no comparison of his specimens with the western races, while the points of distinction between his two described forms are said to lie chiefly in minute differences in the curvature of the horns. His two plates, showing a skull and teeth of each, are obviously much alike and the supposed distinctions between the two animals are doubtless merely matters of individual variation. Nevertheless, it is quite likely that if comparison could be made between specimens from Persia and from the Gobi, differences would be apparent, so that until the two are proved to be really identical, it seems better to use the first of Heude's names for the Mongolian gazelle of the central Gobi Desert in a subspecific sense. Judging from the colored plate in Sclater and Thomas's work on the antelopes, the Mongolian form is much more cinnamon, with paler limbs, and possibly with a shorter tail. Crania of the typical Persian race are not available for comparison. A large series of skins and skulls was secured by the Asiatic Expeditions at Tsagan Nor, as well as at Loh and between Kalgan and Loh.

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NEW SPECIES OF ERISTALINÆ WITH NOTES (SYRPHIDÆ, DIPTERA)

By C. H. Curran

For several years I have had in my possession notes on the types of several species of *Eristalis* Latreille, and allied genera, described by Wiedemann. Publication of these has been delayed pending a more thorough study of the Neotropical species of *Eristalis*. In most cases Wiedemann's species have been correctly identified and redescribed and it seems necessary to give only references to both the original and later descriptions in order to make clear the identity of the species. In some cases new descriptions are given and additional characters elucidated.

Mesembrius quadrivittatus Wiedemann

Eristalis quadrivittatus Wiedemann, 1819, Zool. Mag., I, p. 17; 1830, 'Ausser. Zweifl.,' II, p. 168.

There is a male from the Winthem Collection determined by Wiedemann, which bears a pink square (indicating it is a type?). This is not the case, as the type locality is Tranquebar, while the specimen before me is from Bengal. Mr. Brunetti has redescribed this and the following species, so there is no need to repeat the description here.

Mesembrius bengalensis Wiedemann

Eristalis bengalensis Wiedemann, 1819, Zool. Mag., III, p. 16; 1830, 'Ausser. Zweifl.,' II, p. 167.

The types represent both sexes from the Winthem Collection. In this species the middle tibiæ are between one-third and one-half black while in *quadrivittatus* they are wholly pale. Also the male of the latter has the scutellum wholly pale pilose while in *bengalensis* it is chiefly black-haired.

Mallota? dasyops Wiedemann

Eristalis dasyops Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 171.
Mallota pachymera Bezzi, 1915, 'Syrphidæ of Ethiopian Region,' p. 99.

A female from the Winthem Collection is probably a type, but owing to the fact that it is from this collection, there must be some doubt. The specimen agrees perfectly with Wiedemann's description. That

Bezzi's *Eristalis dasyops* ('Syrph. Eth. Reg.,' p. 93) is wrongly determined is very evident from an examination of the above specimen. The hair of the front is much longer (fully twice as long), as in *E. dasyops* Bezzi, and the eyes of the male are narrowly separated.

Bezzi lists three species of *Mallota* from Africa, but none of them belong to this genus in the strict sense, and they can hardly be placed in *Eristalis*. The termination of the marginal cell is variable, ranging from quite widely open to short petiolate. The four species from Africa may be distinguished as follows.

1. Posterior femora moderately thickened; yellow band on second abdominal segment always entire.......................................2.
   Posterior femora exceedingly thickened; yellow band usually broadly interrupted.......................................3.
2. Third abdominal segment with broad, basal yellow band; hind borders of segments 2–4 with yellow line ....*ænigma* Bezzi.
   Third abdominal segment wholly black; segments without yellow apices *extrema* Loew.
3. Scutellum about half black pilose; at least with broad transverse band; eyes of male distinctly touching for short distance; front of female mostly black pilose, but numerous yellow hairs on lower half, especially laterally and across the middle.............................*pallidibasis* Bigot.
   Scutellum wholly pale pilose; eyes of male conspicuously separated; front of female chiefly pale pilose on lower half................*dasyops* Wiedemann.

Mallota posticata Fabricius

Eristalis posticatus Fabricius, 1805, 'Syst. Antl.,' p. 237.
Eristalis coactus Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 165.

The type male of *coactus* is in perfect condition and is a specimen of *M. posticata* in which the pale pile is restricted to the first one and one-half segments of the abdomen. The origin of Wiedemann's specimen was not known to him. See Williston for description.

Polydontomyia curvipes Wiedemann

Merodon curvipes Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 149.
Triodonta curvipes Williston, 1886, 'Synopsis N. Amer. Syrph.,' p. 206.

The specimen examined is from the Winthem Collection and has been determined by Loew. The type was in Wiedemann's Collection. For description see Williston. Notwithstanding the presence of Loew's determination label, the specimen was undoubtedly determined by Wiedemann in the first place, but is not likely the type.

ERISTALIS Latreille

In 1925, F. M. Hull[1] reviewed the American species belonging to this genus, illustrating most of the species of which he had examples. Unfortunately, a few of the species were misidentified and it has only been by a comparison of types that the matter has been straightened out. A great deal of the synonymy in the Kertesz catalogue is found to be erroneous, but without more material and an examination of the types it is impossible to do more than call attention to the few cases in which species are, without doubt, wrongly placed. Inasmuch as the older descriptions frequently omit important characters, it is possible that older names may apply to some of the species described as new in this paper, although all of the descriptions have been carefully checked.

The key which follows includes all the American species of which there are examples before me.

TABLE OF SPECIES

1. Eyes reddish brown, with more or less confluent dark brown spots.
Lathyrophthalmus æneus Scopoli.
Eyes not spotted...2.
2. Arista plumose or at least with conspicuous pubescence on basal half.......56.
Arista quite bare and of rather even thickness, not conspicuously narrowed before the middle...3.
3. Legs wholly reddish...4.
At least the posterior femora or tibiæ over one-fourth black.................7.
4. Apical half of wings brown on anterior half...............*hortorum* Fabricius.
Wings hyaline or only lightly clouded along veins, the cross-veins sometimes conspicuously clouded...5.
5. Mesonotum dull black with a pair of broadly separated, short median vittæ and side margins ochreous; front and scutellum of male and female wholly yellowish pilose.................................*rufipes* Macquart.
Mesonotum not vittate with transverse pale bands at least along the suture..6.
6. Scutellum with short, black hairs which are abundant on the margins.
præcipuus Williston.
Scutellum with longish pale hair on margins.............*vinetorum* Fabricius.
7. Posterior femora reddish with about the apical third shining black..........8.
Posterior femora black with the apex and sometimes the base reddish........9.
8. Front of female wholly black pilose; thorax without obscure darker vittæ (Guiana)...*alacris* Curran.
Front pale pilose below; thorax with obscure darker vittæ (Brazil).
ochraceus Williston.
9. Scutellum at least with black pile predominating on part of the surface......10.
Scutellum with at most a few scattered black hairs......................40.

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[1] Ohio Journ. Sci., XXV, pp. 11–43, 285–310.

10. Scutellum black with a transverse, rectangular, apical yellow spot, the mesonotum with a pair of gray vittæ in front of the suture . *meigenii* Wiedemann.

Scutellum differently colored or without the gray vittæ . . . . 11.

11. Scutellum dull black, at most the apex shining. . . . . 12.

Scutellum marked with yellow or shining brownish-black. . . . . 13.

12. Apex of scutellum gray pollinose. . . . . *cosmius* Schiner.

Scutellum wholly slaty black . . . . *vierecki*, n. sp.

13. Mesonotum slaty gray with three opaque blackish vittæ. . . . . 14.

Mesonotum differently marked. . . . . 16.

14. Median mesonotal vitta geminate on anterior half. . . . *furcatus* Wiedemann.

Median vitta not geminate . . . . 15.

15. Transverse gray spots on second abdominal segment very broadly connected behind. . . . . *mitis*, n. sp.

The gray spots are very widely separated from each other. . . *parvulus* Williston.

16. Tibiæ, or tarsi, or both partly blackish. 17.

Tibiæ and tarsi wholly reddish. . . . . *cyatheus* Hull.

17. Apex of posterior tibiæ produced as distinct spur or lobe. . . . . 18.

Apex of posterior tibiæ not at all produced. . . . . 28.

18. Scutellum wholly yellowish. . . . . 19.

Scutellum with the base more or less broadly black. . . . . 22.

19. Third abdominal segment black pilose on posterior third or more . . . . 20.

Third abdominal segment without black pile. . . . . *nigripes* Wiedemann.

20. Prescutellar pile black. . . . . 21.

Prescutellar pile yellow. . . . . *mus*, n. sp.

21. Mesonotum wholly opaque black behind the suture. . . . . . . *amazon*, n. sp

Mesonotum with prescutellar grayish or metallic fascia. . . . . . *spectabilis* Hull.

22. Mesonotum behind the suture wholly black pilose except the posterior calli. . . . . 23.

Mesonotum largely yellow pilose behind the suture; ground color of male scutellum almost wholly concealed by short, black pile.
melanaspis Wiedemann.

23. At most the narrow posterior margin of the mesopleura black pilose. . . . . 24.

Posterior half of mesopleura and upper third of sternopleura black pilose.
pygolampus Wiedemann.

24. Scutellum black with a large, subrectangular apical spot pale yellow.
claudia, n. sp.

Scutellum with only the base more or less broadly black. . . . . 25.

25. Scutellum black pilose. . . . . *doris*, n. sp.

Disc of scutellum yellow pilose. . . . . 26.

26. Posterior tibiæ strongly produced at the apex. . . . . 27.

Posterior tibiæ only slightly produced at the apex. . . . . *erraticus*, n. sp.

27. Pile very abundant on sides of mesonotum behind and on sides of scutellum; posterior calli with only a few pale hairs on outer surface in front.
conicus Fabricius.

Pile less abundant, the posterior calli chiefly reddish yellow pilose on outer surface. . . . . *scutellaris* Fabricius.

28. Mesonotum with bluish, grayish or yellowish pollinose fascia behind the suture .... 29.

Middle of mesonotum unicolorous or nearly so behind the suture .... 36.

29. Pteropleural pile partly black .... 30.

Pteropleural pile wholly pale .... 32.

30. Prescutellar fascia not appearing bluish .... 31.

Prescutellar fascia metallic bluish in most lights .... *erraticus*, n. sp.

31. Posterior tibiæ shining black, the base reddish .... *agrorum* Fabricius.

Posterior tibiæ brownish red .... *clarissimus* Giglio-Tos.

32. Front of both sexes wholly whitish pilose on lower half or more .... 33.

Front of both sexes black pilose on whole length in the middle .... 35.

33. Fourth abdominal segment black except the extreme apex. *albifrons* Wiedemann.

Fourth abdominal segment largely red in both sexes .... 34.

34. Male genitalia reddish and ferruginous; third abdominal segment of female two-thirds shining .... *nigripes* Wiedemann.

Male genitalia shining black; third abdominal segment of female with narrow shining fascia .... *rufiventris* Macquart.

35. Front of female very narrow, the ocelli almost touching the eyes. *tenuifrons*, n. sp.

Front of female wider, the ocelli separated from the eyes by about width of single ocellus .... *minutalis* Williston.

36. Posterior calli entirely pale-haired .... 37.

Posterior calli mostly black-haired .... 38.

37. Front above antennæ wholly pale pilose .... *distinguendus* Wiedemann.

Front at least in the middle with black pile .... 73.

38. Mesonotum wholly cinereous in front of the suture .... *pusillus* Macquart.

Mesonotum with a black fascia in front of the suture .... 39.

39. Pteropleura entirely pale-haired .... *urotænia*, n. sp.

Pteropleura partly black-haired in front .... *atrimanus* Loew.

40. With an ashy or metallic fascia situated between the scutellum and suture .41.

Without a prescutellar band .... 46.

41. Posterior tibiæ with a distinct apical triangular production on outer ventral apex .... 42.

Posterior tibiæ not produced .... 44.

42. Prescutellar ashy band narrow, separated from the scutellum by almost its width .... *langi* Curran.

Prescutellar fascia rather cyaneous, not broadly separated from the scutellum .... 43.

43. Posterior tarsi wholly yellow .... *mirabilis* Hull.

Posterior tarsi wholly black .... *mus*, n. sp.

44. Posterior tibiæ ciliate .... *vinetorum* Fabricius.

Posterior tibiæ not ciliate .... 45.

45. Mesonotum wholly gray in front of suture .... ?*alhambra* Hull.

Mesonotum with opaque black presutural fascia .... *agrorum* Fabricius.

46. Mesonotum opaque black with a strikingly contrasting presutural fascia of white to whitish ochraceous .... 47.

Mesonotum not opaque black and only obscurely fasciate .... 50.

47. Pale presutural fascia entire . . . . 48.
Pale presutural fascia broadly interrupted leaving a triangle at either side. *triangularis* Giglio-Tos.
48. Hypopleura entirely pale-haired . . . . 49.
Hypopleura mostly black-haired . . . . *fasciatus* Wiedemann.
49. Front of both sexes largely black-haired in the middle . . . . . . *urotænia*, n. sp.
Frontal triangle of male and lower half of front of female wholly white pilose. *pusio* Wiedemann.
50. Posterior tibiæ ciliate . . . . 51.
Posterior tibiæ not ciliate . . . . 52.
51. Frontal triangle of male and front of female wholly pale pilose. *testaceicornis* Macquart.
Frontal triangle of male and front of female in the middle, black pilose. *obsoletus* Wiedemann.
52. Front of both sexes wholly pale pilose, at least on lower half . . . . 53.
Front of both sexes black pilose at least in the middle on whole length . . . . . 55.
53. Mesonotum shining . . . . 54.
Mesonotum opaque with pollen . . . . *distinguendus* Wiedemann.
54. Second abdominal segment with a posterior black fascia . . . *latifrons* Loew.
Second segment wholly reddish laterally . . . . *bellardii* Jænnicke.
55. Middle tibiæ wholly yellow, the apex rarely brownish . . . . . *philippii* Schiner.
Middle tibiæ black on apical third . . . . *assimilis* Macquart.
56. Third abdominal segment wholly shining . . . . 57.
Third segment with at least a small opaque black spot or triangle in the middle or with opaque black fascia . . . . 61.
57. Tarsi wholly reddish yellow . . . . *flavipes* Walker.
Tarsi partly black or brown . . . . 58.
58. Pile of eyes arranged in vertical bands . . . . 59.
Pile of eyes not forming bands . . . . 60.
59. Posterior femora wholly black . . . . *tenax* Linnæus.
Posterior femora reddish on basal fourth . . . . *tenax campestris* Meigen.
60. Wings reddish brown on basal half in front . . . . . . *compactus* Walker.
Wings with a large median brown spot in front . . . . . *rupium* Fabricius.
61. Face with a median shining black stripe . . . . 63.
Face wholly pale pollinose or pubescent . . . . 62.
62. Middle tarsi wholly black or brown . . . . *brousii* Williston.
Middle tarsi reddish yellow basally . . . . *arbustorum* Linnæus.
63. Mesonotum fasciate with cinereous and opaque black . . *transversus* Wiedemann.
Mesonotum unicolorous or nearly so . . . . 64.
64. Posterior calli mostly black pilose . . . . . . *dimidiatus* Wiedemann.
Posterior calli pale pilose . . . . 65.
65. Pile of head and thorax reddish, largely concealing the ground color. *circe* Williston.
Pile of head and thorax yellowish or not sufficiently abundant to conceal the ground color . . . . 66.
66. Sides of mesonotum with long, pale yellowish pile concealing the ground color . . . . 67.
Pile shorter and not concealing the ground color . . . . 69.

67. Third abdominal segment with a broadly interrupted opaque black anterior fascia. . . . . *pilosus* Loew
Third segment with entire anterior fascia or none. . . . . .68.
68. Scutellum shining; abdomen largely æneous . . . . . *anthophorinus* Fallén.
Scutellum dull or very slightly shining; abdomen black. . . .*bastardi* Macquart.
69. Deep bluish-black in color . . . . *saxorum* Wiedemann.
Not at all bluish. . . . . 70.
70. Base of posterior femora reddish. . . . . .71.
Posterior femora wholly black. . . . . .72.
71. Third abdominal segment with an opaque black anterior fascia. *obscurus* Loew.
Third segment with at most a median opaque black triangle in front *temporalis* Thomson.
72. Wings reddish brown on anterior half in front. . . . .*compactus* Walker.
Wings not strikingly bicolored . . . . *neomorum* Linnæus.
73. Pile black on posterior fourth of mesonotum . . . .*tatei,* n. sp.
Pile of mesonotum wholly pale reddish yellow. . . . .*philippi* Schiner.

Eristalis dimidiatus Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 180.
Williston, 1886, 'Synopsis N. Amer. Syrph.,' p. 162.

A male from the Winthem Collection is undoubtedly a type but the female from Kentucky probably does not belong to the type series.

Eristalis saxorum Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 158.
Williston, 1886, 'Synopsis N. Amer. Syrph.,' p. 163.

The type is a female from Savanna, in the Winthem Collection.

Eristalis transversus Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 188.
Williston, 1886, 'Synopsis N. Amer. Syrph.,' p. 170.

The type is a female from the Winthem Collection and probably represents one of several specimens before Wiedemann at the time he made his description. The arista is long-haired basally, thus distinguishing the species from all others from America which have the mesonotum pale fasciate.

Eristalis obsoletus Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 175.

A female from Brazil, from the Winthem Collection, I take to be a type, but a male from the same collection labelled "America merid." probably was not included in the type series and a second label, "America sept.," is a most evident error. I have not seen this species from Mexico, but have it from Brazil and Venezuela. There are two species usually confused here. The second is *E. testaceicornis* Macquart, originally described from Mexico, but quite distinct. The obvious characters separating them may be summed up as follows.

A. Frontal triangle black pilose above and in middle; posterior tibiæ sparsely black pilose anteriorly and posteriorly; female front black pilose, with pale pile on the sides of the lower half and narrowly along the orbits above; posterior margin of second to fourth abdominal segments black pilose except at sides, the sixth rarely wholly pale pilose. . . . . *obsoletus* Wiedemann.

B. Frontal triangle of male, front of female, and abdomen of female wholly pale pilose; posterior tibiæ with sparse yellow pile anteriorly and posteriorly. *testaceicornis* Macquart.

I have seen *testaceicornis* from different parts of Central America and Peru, in addition to Mexican specimens.

Eristalis meigenii Wiedemann

Eristalis meigenii Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 177.

Eristalis quadraticornis Macquart, 1842, 'Dipt. Exot.,' II, part 2, p. 51; Hull, 1925, Ohio Journ. Sci., XXV, p. 29.

Eristalis testaceiscutellatus Macquart, 1850, 'Dipt. Exot.,' Suppl., IV, p. 442.

The type, a male, is in perfect condition and as the species is a very distinct one there can be no doubt about its identity. Mr. F. M. Hull has determined specimens for me as *testaceiscutellatus* and has redescribed the species (*loc. cit.*), which is an interesting one from the standpoint of students of the Nearctic fauna as Osborn placed *E. brousii* Williston as a synonym. While the two species are strikingly distinct, the description, as given by Wiedemann, agrees in many respects with *brousii*. In *meigenii* the sides of the scutellum bear an opaque-black triangle and the base is also narrowly dull black, leaving a rectangular yellow spot; this serves to at once distinguish the species.

Eristalis distinguendus Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 191, (male).

Eristalis xanthaspis Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 191, (female).

The male specimen is undoubtedly the type, but the female which agrees perfectly with the description of *xanthaspis* may not be, as it is from Buenos Aires. However, Wiedemann does not mention the locality. The male is from Wiedemann's Collection, the female from Winthem's. Wiedemann's description is fairly complete. The following notes should render the species easily identifiable in conjunction with the original description.

Male.—Head silvery-white pollinose, the vertical triangle brownish yellow, the occiput more yellowish pollinose above only; cheeks with large shining black triangle; face with rather narrow, shining rusty yellow median vitta; pile of face, front, and posterior orbits white or whitish; of ocellar region, fuscous. Thorax pale yellowish pilose, the yellow scutellum with scattered black hairs on the disc. Second and third abdominal segments yellow, with a broad, median opaque black vitta which widens in front and behind, the pile yellow but somewhat fuscous on posterior half of the second and third segments; narrow apices of segments bright yellow. Middle tibiæ wholly yellow or only a little darkened at apex.

Female.—Front brownish ochreous on more than the upper half, with a broad black orbital vitta and a slender median one in front of the ocelli, the lower portion of the front whitish pollinose with the middle more yellowish; the pile is black on less than the upper half, white below. The median abdominal vitta is broader and widens posteriorly on the second segment, while on the third there is a variable reddish spot separating the median vitta from the broadly black sides.

Eristalis philippi Schiner, which is superficially similar to *distinguendus*, is readily distinguished by the black pilose front.

Eristalis tatei, new species

Mesonotum brownish, the posterior fourth opaque black, the dorsum with a pair of widely separated brownish yellow vittæ. Length, 11 to 12 mm.

Male.—Face and lower three-fifths of occiput densely cinereous white pollinose, a median vitta on the lower two-thirds of the face reddish brown. Frontal triangle and upper part of occiput with brownish-yellow pollen, the vertical triangle brown. Pile yellowish, on the frontal and vertical triangles and the occipital cilia, black. Vertical triangle broader than long; a weak tubercle on the frontal triangle. Cheeks shining black in front. Antennæ brownish red, the arista brown, bare. Eyes with reddish-yellow pile.

Thorax with reddish-brown pollen, the pleura becoming gray below, the posterior fourth of the mesonotum opaque black, emitting a median and sublateral triangles forward, the median sometimes connected with the geminate median dark vitta; on either side of the median dark vitta is a broad brownish yellow vitta reaching from the anterior margin to the opaque-black band; lateral margins brownish yellow. Pile reddish, black on the posterior third of the mesonotum and on the scutellum. Scutellum dull, pale orange, the immediate base black, the ventral fringe yellow.

Femora shining black, their apices reddish; anterior four tibiæ ferruginous, paler basally, the posterior tibiæ browish with reddish apex, base and incomplete median band. Tarsi brownish, the basal segment reddish.

Wings hyaline, tinged with luteous on the anterior half to beyond the middle. Squamæ brownish, with brown border and fringe. Halteres pale orange.

Abdomen black and orange. First segment black. Second segment orange, the narrow base, except at the sides, and a very broad, posteriorly tapering median vitta, opaque black. Third segment orange with a narrower, opaque-black median vitta which expands to form a pre-apical brownish fascia. Fourth segment shining black, with a broad, laterally tapering opaque-black basal fascia, a narrower one posteriorly and a linear median vitta. Apices of the second to fourth segments reddish. Genitalia shining black. Pile reddish yellow, black on the posterior half of the second segment, where it expands laterally to reach the basal fourth of the segment and on the third segment with the exception of the lateral margins.

TYPES.—Holotype, male, Mt. Duida, Venezuela, January 11, 1929; paratypes, two males, Mt. Duida, January 11, (G. H. H. Tate).

This species is most nearly allied with *bogotensis* Macquart but is at once distinguished by not having the basal half of the tibiæ whitish and the presence of black pile on the mesonotum. The color of the thorax is very similar in these two species but not at all like *bellardii* Jænnicke, a supposed synonym of *bogotensis*.

Eristalis vierecki, new species

Related to *cosmius* Schiner but lacking the triangular cinereous spots on the posterior part of the mesonotum and with the scutellum unicolorous. Black, the abdomen with three pairs of orange spots. Length, 11 mm.

MALE.—Head wholly black, grayish-white pollinose, the frontal triangle with brown pollen except laterally, the vertical triangle opaque black. The eyes are separated by almost twice the width of the anterior ocellus. Pile of the face, cheeks, lower half of occiput and lower fifth of eyes, whitish, elsewhere black. Face with a median shining black vitta, the cheeks black in front. Eyes brown pilose. Antennæ brown; arista bare.

Thorax slaty black with opaque-black markings as follows: a narrow median vitta, a transverse triangle on either side adjacent to the suture, an obscure stripe on either side in front of the inner ends of the suture, and a large spot on the pleura occupying the posterior border of the mesopleura and a large part of the pteropleura. Pile black; notopleura, upper part of mesopleura, plumula, and the hypopleura beneath the squamæ with some yellow pile. Notopleura with brownish-yellow pollen. Scutellum slaty black, the ventral fringe yellow.

Legs black; femora with some whitish pile basally; anterior tibiæ entirely tawny pubescent on ventral surface. Posterior femora moderately swollen, their tibiæ broadened and flat on ventral surface apically.

Wings pale luteous, the small stigmal spot black. Squamæ brown, with black fringe, the lower lobe broadly whitish basally. Halteres reddish yellow.

Abdomen opaque black, with three pairs of orange spots. The spots on the second segment are broadly separated from each other but only narrowly so from the margins of the segment, their inner ends subtruncate. The spots on the third segment are separated from the posterior and lateral margins, their inner ends oblique, the median black vitta narrowed posteriorly. On the fourth segment the spots are similar to those on the third but they occupy only the basal half of the segment and their posterior third is shining except in the middle. Pile black; yellow on the first segment, base of the second laterally and on the genitalia. The intermediate segments are denuded, the color of the pile therefore doubtful. Genitalia shining black. Apices of second to fifth segments pale yellowish.

HOLOTYPE.—Male, Vista Nieve, Colombia, December 17, 1922, (H. L. Viereck).

This is the only American species I have seen in which the eyes of the male are separated. I have only females of *cosmius* Schiner but the eyes of the male are described as contiguous.

Eristalis furcatus Wiedemann

WIEDEMANN, 1819, Zool. Mag., I, p. 51; 1830, 'Ausser. Zweifl.,' II, p. 176; HULL, 1925, Ohio Journ. Sci., XXV, p. 29.

Type male and female from Wiedemann's Collection. The female has the scutellum wholly black, while in the male it is shining rusty reddish, with darker base. Wiedemann states that the scutellum is shining brownish black with lighter apex, but this character applies better to the female than to the type male. However, the color is variable, sometimes being almost black, and with shades intermediate between this and brownish red.

Eristalis mitis, new species

Very similar to *parvulus* Williston but at once distinguished by the entire gray pollinose fascia on the second abdominal segment. The mesonotum is slaty gray with three opaque-black vittæ. Length, 7.5 to 8.5 mm.

FEMALE.—Face and cheeks white pollinose, a triangle on the cheeks and a broad, entire facial vitta shining black, the latter with pollen above. Front yellow pollinose on lower two-thirds, with a median opaque-black vitta and a subrectangular shining black spot immediately above the antennæ; a broad band of opaque-black across the upper third of the front, the pollen between this point and the antennæ yellowish brown; ocellar triangle blackish. Pile of face, lower half of occiput and sides of the front on lower half, white; on the middle and upper part of the front, black; occipital pile yellow, the cilia black. Facial tubercle large, the face concave above and below; front rather narrow above, widening on the lower two-thirds, the ocellar triangle broadly separated from the eyes. Antennæ blackish, the basal segments and arista reddish brown. Eyes black pilose on upper half, white below.

Mesonotum slaty gray, with more or less brownish tinge; three opaque-black vittæ, the outer ones interrupted at the suture and represented in front by a rectangular black spot, the opaque black extending narrowly along the suture to unite with a lateral triangle of the same color. The lateral vittæ taper from the suture to the scutellum while the median one is linear in front and widest just before the posterior border of the mesonotum. Pile yellow in front of the suture, on the broad sides, and on the pleura, behind the suture and on the scutellum, black, moderately long on the scutellum. Pleura gray pollinose, the sternopleura mostly shining black. Scutellum slaty with a subrectangular yellow apical spot which is preceded by a narrow, transverse opaque-black mark.

Legs black; coxæ thickly gray pollinose; tibiæ shining brownish; knees obscure reddish. Posterior femora strongly swollen.

Wings hyaline, the broad apex and posterior border cinereous; stigma short, dark brown; marginal cell gently widened before its apex. Squamæ white on basal half, brown apically, the fringe pale yellowish. Halteres yellow.

Abdomen opaque black and gray, the tips of the segments pale yellow. First segment gray with a broad black spot on either side posteriorly. Second segment with a basal black fascia which does not reach the sides and is rectangularly produced in the middle to more than half the distance to the posterior border and is also somewhat widened toward either end; posterior border very broadly black except laterally, the band narrowest in the middle, widest toward either side and cut off obliquely so that it scarcely reaches the posterior angle of the segment. Third to fifth segments each with a broad gray fascia across their middle which widens laterally so as to reach almost the whole length of the segment and on the third segment extends narrowly inward along the base. Pile whitish on the base, sides and fifth segment, on the dorsum very inconspicuous. Sides of abdomen æneous.

TYPES.—Holotype, female, and two paratypes, Corozal, Canal Zone, February 4, 1929, (Curran).

This description would apply very well to *parvulus* Williston with few exceptions. The legs of *parvulus* are more extensively pale and the gray color does not extend inward along the base of the third abdominal segment. The males of both species are unknown.

Eristalis tenuifrons, new species

Mesonotum with three yellowish-gray pollinose fasciæ, the posterior one in the shape of a shallow U; lateral ocelli almost touching the eyes; front black pilose except on the sides of lower third. Length, 7.5 mm.

FEMALE.—Face yellow, white pollinose, a broad median vitta occupying the lower two-thirds, oral margin and cheeks shining black. Front narrow, widening and white pollinose on lower two-thirds, the pollen with brownish tinge in the middle and leaving a large shining black spot immediately above the antennæ; upper part of front grayish brown, separated from the white portion by an opaque-black fascia; ocellar triangle dull brown. Cheeks posteriorly and the posterior orbits white pollinose and pilose; occipital cilia black. Facial tubercle prominent, moderately large, the face concave above. Antennæ reddish, the third segment reddish brown above.

The presutural brownish-black fascia is about as wide as the following gray fascia, while the posterior grayish fascia reaches the posterior border of the mesonotum and extends forward laterally to reach the notopleura narrowly along the lateral margin; the anterior gray fasciæ are divided by a very broad median slaty vitta. Pile of mesonotum yellowish, mixed with black behind the suture and all black immediately in front of the scutellum; pleural pile whitish. Scutellum with erect black pile, pale yellowish in ground color, the basal fourth opaque black. Pleura gray pollinose.

Coxæ black, gray pollinose; femora shining black, their apices reddish, the pile pale yellow. Tibiæ brown, the anterior four with the basal third or more reddish yellow, the posterior pair shining brownish red on the basal half; anterior four tarsi with the basal two segments reddish; tarsi blackish. Posterior femora strongly incrassate.

Wings hyaline; veins black. Squamæ whitish, with brown border and brownish yellow fringe. Halteres yellow.

Abdomen black, with four dull-reddish spots. First segment opaque blackish, thinly gray pollinose in the middle anteriorly, its anterior border pale yellowish laterally. Second segment with a pair of large, subtriangular reddish spots which are broadly separated from each other, do not touch the lateral margins and have their inner ends obtusely rounded or subtruncate, the spots shining on their outer two-thirds; the black part is opaque black, the sides of the abdomen wholly shining.

Third segment with a triangular, basal reddish spot toward either side, opaque brownish black, with a large shining spot on either side which is produced rather narrowly inward along the middle of the segment, the arms gently curved posteriorly. Fourth segment opaque blackish posteriorly and in the middle, the basal half shining black; a slender, tapering opaque fascia reaches along the base from the median vitta about halfway to the lateral margins. Fifth segment wholly shining black. Tips of the segments pale yellow. Pile yellowish, black on the posterior third or more of the second and third segments and the whole of the fourth except laterally.

HOLOTYPE.—Female, Fort Randolph, Canal Zone, February 6, 1929, (Curran).

This species very closely resembles *minutalis* Williston in general appearance. In addition to having a much narrower front the scutellum is very much paler and the abdominal markings are smaller and of a deeper red.

Eristalis tænia Wiedemann

WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 174.

A male from Montevideo from the Winthem Collection and a female which is beyond doubt the type of that sex, as it bears a label "*tænia* ♀ ?" in Wiedemann's writing. This latter specimen is slightly stained in front of the thoracal suture which probably caused Wiedemann to question its association with the males. The abdominal markings vary somewhat, especially on the third segment. The male agrees well with the female so the species should be readily recognized from the description of the female given by Hull. Hull does not give sufficient detail of the color of the frontal pile, a character rather important in this group. The front is brownish-yellow pollinose with the sides on the lower half whitish; almost the upper half of the front is clothed with black pile and this runs down less abundantly over the yellowish pollen almost to the antennæ. The posterior tibiæ vary in color from about half reddish to almost wholly black. The following species is very close to *tænia* but very distinct in the male.

Eristalis pusio Wiedemann

WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 192.

Allied to *E. tænia* Wiedemann but readily distinguished by the longer front, less widely contiguous eyes and smaller size in the male, and in the female by the black pilose upper two-fifths of the front and white pilose lower three-fifths. In the male the eyes touch for a distance not greater than the width of the ocellar triangle, while in *tænia*, they touch for about twice this distance and the front is shorter, more swollen, the pile is yellowish tinged. Length, 8 to 9 mm.

MALE.—A large triangle on the cheeks and a narrow facial stripe not reaching the antennæ, shining brownish; frontal triangle, face and lower half of occiput silvery whitish pollinose, the upper half of the occiput and vertical triangle rather ochreous, although the ocelli are surrounded by opaque black which leaves a Y-shaped brownish-yellow mark between them. Vertical triangle and eyes with dense, black pile, the latter bare on lower fifth, the front, face and lower half of occiput silvery-white pilose, the pile of the occiput yellow above, the cilia fine, black. Antennæ reddish.

Thorax with a transverse band of grayish-yellow pollen occupying the area in front of the suture except a conspicuous black band above the anterior slopes which does not reach the sides, the mesonotum elsewhere opaque black, the pleura gray pollinose and whitish pilose, the mesonotum yellow pilose to slightly behind the suture and narrowly along the sides behind, the posterior calli above and the black of the mesonotum black pilose. Scutellum opaque yellow, yellow pilose, only a few scattered black hairs.

Legs shining black, the apices of the anterior four femora, basal half of the anterior tibiæ, basal three-fourths of the middle ones and immediate base of the hind pair, yellow, the first segment of the anterior four tarsi reddish with black apex. Legs mostly yellow pilose except as follows: black on the apical half of the middle femora in front; on apical fourth of posterior femora and all of posterior tibiæ, except the apical half of the posterior surface, where it is pubescent-like and appressed; the tarsi wholly, and on the black portions of the anterior four tibiæ. On the posterior tibiæ the hair above and below is noticeably long and abundant.

Wings hyaline, not at all clouded. Squamæ yellow, with yellow fringe, the upper lobe fuscous. (In *tænia* the squamæ are chiefly fuscous in both sexes.) Halteres yellow.

Abdomen opaque, only a broad, sub-basal, moderately interrupted band on the fourth segment and the genitalia shining black, the third segment sometimes with a small shining roundish spot on either side near the middle. First segment grayish, the sides broadly yellow, the portion under the scutellum chiefly blackish. Second segment lemon-yellow with a rather narrow median opaque-black vitta which widens posteriorly but hardly reaches the apex. Third segment yellow, with a large apical triangle which reaches the base broadly in the middle but extends little more than halfway to the sides posteriorly, the apex of the third and fourth segments narrowly yellow. Abdominal pile yellow, the second segment with a posterior, transverse black pilose triangle, the third with the posterior half black pilose, the pile reaching forward laterally.

FEMALE.—Upper two-fifths of front yellowish-brown pollinose and black pilose, the lower portion white pollinose although in the middle there is a yellowish vitta, the pile whitish.

Second abdominal segment with a small black apical triangle, the anterior point of which is attenuated considerably before the base of the segment, the yellow on the third segment limited to a transverse basal spot on each side. Third segment with a more or less distinct, interrupted shining black fascia across the middle, the fourth and fifth with increasingly wider median fasciæ, that on the fifth segment entire.

Redescribed from type female and four specimens from Flores, Mananas, Amazonas, July 29, Aug. 2 and 4, 1924, collected by Dr. Jos. Bequaert. The type is from the Winthem Collection, "determined" by Wiedemann, and is in fairly good condition.

Eristalis urotænia, new species

This species is evidently related to *pusio* Wiedemann but the presence of black hair on the frontal triangle of the male and the lower half of the front in the female separates it. The frontal triangle of the male is convex while in *pusio* it is almost flat. It also approaches *pusillus* Macquart but the pile of that species is of the same color as in *pusio*. Except that the presutural pale pollinose band is entire it agrees with *triangularis* Giglio-Tos and large series might prove it to be only a variety of *triangularis*. However, it is very distinct in appearance and it seems best to describe it. The presutural band is entire and cinereous in color, preceded by a narrow or wide opaque-black fascia which may or may not attain the lateral margins, the anterior border of the mesonotum more or less broadly dark grayish; mesonotum opaque black behind the suture. Scutellum dull yellow. Length, 9 to 10.25 mm.

MALE.—Face and sides of front yellow in ground color, the front brownish yellow in ground color and densely brownish-yellow pollinose; sides of the front, the face, cheeks and occiput white pollinose the pollen becoming yellowish on the upper part of the occiput, the pile similar in color to the pollen; a median vitta on the face and the lunula translucent reddish yellow, the cheeks brown in front. Vertical triangle brownish-yellow pollinose and black pilose, the pile of the frontal triangle mixed yellow and black. Occipital cilia black. Facial tubercle long and nose-shaped. Antennæ reddish yellow. Eyes with black hair which appears to be somewhat patchy.

Mesonotum opaque black behind the suture, with a broad grayish-yellow band immediately before the suture and a brownish anterior fascia, between these opaque brownish. Pile yellow in front, black behind, wholly black on the posterior calli. Pleura grayish-white pollinose and yellow pilose. Scutellum dull yellowish with black and yellow pile, the latter predominating.

Coxæ and femora black; coxæ pale pollinose, apices of femora reddish yellow; posterior tibiæ brown, yellow at the base; anterior four tibiæ yellow, the front ones broadly reddish brown apically. Tarsi yellow, the apical two segments of the anterior four and the posterior pair entirely reddish brown. Posterior femora moderately incrassate.

Wings hyaline, the base brown. Squamæ wholly brown. Halteres yellow.

Basal three abdominal segments yellowish, the fourth black. Second segment with a narrow, median opaque-black triangle; third with a much broader, subtriangular spot which is truncate anteriorly. Fourth segment opaque black with a rather narrow, shining fascia which lies mostly before the middle of the segment. Genitalia shining black, yellow pilose. First segment, most of the second and the sides of the third and fourth, yellow pilose, the pile elsewhere black. On the second segment the lateral margins are black pilose except at the base. Tips of second and following segments pale yellow.

FEMALE.—Front whitish yellow pollinose on lower half, above pale yellowish brown, in front of the ocelli with a narrow opaque-black fascia from which three lines extend forward, the outer ones resting on the orbits and shorter than the median vitta which reaches halfway to the base of the antennæ; the middle of the front rather ochreous or brownish red in front of the black vitta and clothed with black pile, the lower half of the front pale yellow pilose except medianly, the upper portion black-haired. Pile of the eyes tawny brown. Thorax as in the male although the presutural blackish band may be broader leaving only an obscure anterior fascia of a paler color. Second abdominal segment with the opaque-black triangle produced posteriorly to form a narrow fascia. Third segment with the posterior third to half black, the lateral margins also black; and with traces of a narrow, shining black fascia. The shining fascia on the fourth segment is only narrowly separated from the base. Fifth segment shining black except the narrow base.

TYPES.—Holotype, male, allotype, female, and one female paratype, Chapada, Brazil, (Williston Collection).

Eristalis fasciatus Wiedemann

WIEDEMANN, 1819, Zool. Mag., III, p. 51; 1830, 'Ausser. Zweifl.,' II, p. 173.
HULL, 1925, Ohio Journ. Sci., XXV, p. 34.

A male and female from the Winthem Collection are undoubtedly types.

Eristalis atrimana Loew

LOEW, 1865, Berl. Ent. Zeitschr., IX, p. 167.

The following is a redescription of this little known species.

MALE.—Length, 12 mm. Face and frontal orbits below silvery white, the former with a moderately broad shining black median vitta; front brown pollinose and wholly black pilose; face with fine white pile; cheeks shining black; occiput silvery-white pollinose on lower half or more, yellowish-brown pollinose and black-haired on upper third; vertical triangle reddish-brown pollinose, black-haired, one-third longer than wide, rather short, the eyes contiguous for a slightly longer distance than length of vertical triangle; shining black lunular area half as long as frontal triangle, rounded above; a conspicuous low frontal swelling above the lunula. Eyes with short fuscous pile. Antennæ brown.

Thorax opaque black, the pleura pale pollinose below in front and behind; a narrow, complete yellow pollinose sutural fascia in front of which the pile is yellowish, elsewhere on the opaque part, black. Scutellum opaque reddish yellow, with moderately long, not abundant black pile, the ventral fringe yellow.

Legs black; apices of anterior four femora, basal third of anterior four and fifth of the posterior tibiæ yellowish; first segment of middle tarsi brownish red. Pile black, the usual pubescent areas tawny or golden; posterior femora with pale hairs basally and long yellow hairs below; anterior four tibiæ with sparse short yellow hairs in front.

Wings hyaline, tinged with luteous except behind and apically. Squamæ black, the base of the lower lobes grayish. Halteres reddish.

Abdomen opaque black and rusty reddish; third segment with a pair of small shining spots in the middle, fourth with a broad metallic bluish median fascia which is narrowly interrupted in the middle, genitalia shining black. First segment reddish on the sides, second with broad black median vitta which is strongly broadened at its apical fifth and narrows slightly to the base, third segment with a similar vitta but it is broadened on the apical half. Apices of third and fourth segments pale yellow. Pile wholly black except on the first and basal third of second segment.

Eristalis agrorum Fabricius

Syrphus agrorum Fabricius, 1787, 'Mant. Insect.,' II, p. 335; 1794, 'Ent. Syst.,' IV, p. 285.

Eristalis agrorum Fabricius, 1805, 'Syst. Antl.,' p. 235; Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 172.

Eristalis cubensis Macquart, 1842, 'Dipt. Exot.,' II, part 2, p. 42; Bigot, 1856, in Sagra, 'Hist. la Isla de Cuba,' VII, pt. 2, p. 337; Hull, 1925, Ohio Journ. Sci., XXV, p. 38; Curran, 1928, 'Sc. Surv. Porto Rico and Virgin Islands,' XI, part 1, p. 43.

This species was originally described from the West Indies, probably from St. Thomas, but has remained unrecognized. Wiedemann recorded it from Brazil. The records of Williston and Hull refer to *mus*, new species. *E. agrorum* is widely distributed in America, ranging from Florida to Brazil. It is one of the few species which shows variation in the color of the scutellar pile: in rare cases the pile is almost all yellow while normally there are only a few pale hairs on the margins.

Eristalis scutellaris Fabricius

Milesia scutellaris Fabricius, 1805, 'Syst. Antl.,' p. 190.
Eristalis scutellata Macquart, 1842, 'Dipt.-Exot.,' II, pt. 2, p. 38.
Eristalis cyaneifera Walker, 1849, 'List Dipt. Brit. Mus ,' III, p. 621.
Eristalis fascithorax Macquart, 1849, 'Dipt. Exot.,' Suppl. IV, p. 139.
Doliosyrphus rileyi Williston, 1886, 'Synopsis N. Amer. Syrph.,' p. 178.

The Kertesz catalogue lists several additional names under the synonymy of *scutellaris*, most of which are probably correctly placed. Two of the names do not apply to this species: *Palpada scutellata* Macquart, (1834), is the same as *conica* Fabricius; *limbatineuris* Macquart evidently does not even belong to the same group since the mesonotum is wholly black behind the suture and it is described as resembling *fasciatus* Fabricius.

Unless the type of *scutellaris* is still in existence it will be necessary to follow Wiedemann's interpretation of the species, which was described from a badly damaged specimen. *Scutellaris*, according to Wiedemann, has the tibiæ brownish and the form which I have accepted as this species agrees. The posterior tibiæ are shining reddish brown and bear a triangular spur on the apex of the posteroventral surface. A male from Panama agrees in all respects but has the posterior tibiæ black and the scutellum pale yellow. It seems to be only a variation although I have seen no other specimens at all approaching it.

Eristalis melanaspis Wiedemann

WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 176.
Eristalis volaticus WILLISTON, 1888, Trans. Amer. Ent. Soc., XV, p. 280.

There is a male from Brazil which is probably a type although it is from the Winthem Collection. At any rate, it was determined by Wiedemann. Wiedemann's description is somewhat misleading as the scutellum and hind margin of the thorax is stated to be deep black; this color is due to dense pile. The male is very distinct on account of the vestiture of the scutellum, which leaves only a small apical yellow spot free of dense pile.

Eristalis claudia, new species

Resembles *melanaspis* Wiedemann but the scutellar pile is less abundant and does not conceal the ground color and the mesonotum is black pilose behind the suture. The scutellum is opaque black with a semi-circular apical spot of dull yellow. Length, 12 mm.

MALE.—Face, cheeks and posterior orbits white pollinose and pilose. Head black in ground color, a median facial vitta occupying the lower two-thirds and the cheeks in front shining black. Frontal triangle shining black, the sides brownish-yellow pollinose, in the middle with a large, low tubercle; pile black, narrowly yellow along the orbits. Vertical triangle opaque black; short black pilose. Occiput narrow above, yellowish pollinose, the occipital cilia black. Facial tubercle long and nose-shaped. Antennæ brownish black; arista dull reddish. Eyes short black pilose above, bare below.

Mesonotum with a brownish anterior fascia followed by one of opaque black, the presutural fascia brownish yellow and about as wide as the anterior opaque black one; immediately behind the suture is a very broad opaque-black fascia, the posterior fourth of the mesonotum shining blackish blue, thinly brownish-yellow pollinose; posterior calli opaque black. Pile yellow in front of the suture, black behind, not dense immediately in front of the scutellum. Pleura cinereous white pollinose and white pilose; sternopleura black on the anterior two-thirds and bearing black pile. Scutellar pile wholly black, abundant on the base and sides but not concealing the ground color.

Legs black; tips of anterior four femora and base of their tibiæ obscurely, reddish. Posterior femora strongly incrassate; posterior tibiæ ending in a strong, triangular spur.

Wings brownish, paler on basal half and posteriorly. Squamæ brown, their outer basal corner white; fringe brown. Halteres pale yellowish.

Abdomen opaque black, with four large pale orange spots. Second segment with a very broad median vitta and the posterior sixth opaque black, the sides dull brown. The pale spots on the third segment occupy the basal two-thirds, are separated from each other by almost the width of either spot and from the lateral margins by a brown vitta. Fourth segment with a broad, interrupted shining blackish-blue fascia which widens laterally so that its posterior corners almost reach the posterior angles of the segment, its anterior border transverse and lying at the basal fourth of the segments. Tips of the second to fourth segments yellow. Pile of the dorsum very short, black; yellow on the yellow spots, first segment, lateral margins and genitalia, wholly black on the lateral margins of the second segment. Genitalia shining black.

HOLOTYPE.—Male, Barro Colorado Island, Canal Zone, February 18, 1929, (Curran).

Eristalis erraticus, new species

Superficially similar to *scutellaris* Fabricius but at once distinguished by the presence of only a short, rounded lobe on the apex of the posterior tibiæ. In *scutellaris* the tibiæ are triangularly produced. Mesonotum fasciate with brownish, yellowish, opaque black and bluish black; abdomen of male with four, of female with at most two pale orange spots. Length, 10.5 to 13 mm.

MALE.—Head black in ground color; face, sides of front narrowly, cheeks and posterior orbits, white pollinose; a broad median vitta on the lower two-thirds of the face, a triangle or stripe on the front of the cheeks and the frontal triangle, shining black; pile white, black on the vertical and frontal triangles, except the very narrow sides of the latter, and on the eyes; occipital cilia black; front with a prominent median tubercle; eyes bare below. Vertical triangle opaque black, pale pollinose in front. Facial tubercle large, prominent, oval. Antennæ blackish brown, the arista reddish brown.

Anterior brownish-pollinose fascia on the mesonotum very narrow, usually represented by a spot on either side; presutural fascia grayish yellow, much narrower than the preceding opaque-black fascia which is about as wide as the one immediately behind the suture; prescutellar blackish-blue fascia very broadly separated from the scutellum and under high magnification appearing grayish. Pile black, the presutural pale fascia wholly yellow-haired and yellow hairs are intermixed with the black toward the front of the mesonotum, except laterally. Pleura whitish gray, pale yellowish pilose, the pteropleura deep black and black pilose. Scutellum dull reddish yellow, short black pilose, the base narrowly dull black.

Legs black; coxæ gray pollinose; tips of anterior four femora and basal segment of middle tarsi, reddish; anterior four tibiæ yellowish on basal half or less. Posterior femora strongly incrassate; posterior tibiæ slightly produced at ventral apex.

Wings moderately brownish, somewhat paler on basal half. Squamæ brown, the outer basal corner broadly whitish; fringe brownish yellow. Halteres yellow.

Abdomen opaque; first segment black; second with a broad black median vitta which is expanded narrowly along the anterior margin and broadly along the posterior margin to reach the sides of the segment narrowly, the sides of the segment dull brownish, the large spots pale orange in color. Almost the basal two-thirds of the third segment is pale orange, the fascia broadly interrupted in the middle except at the extreme base of the segment, and extending over the lateral margins; fourth segment with a broad, narrowly interrupted median blackish-blue fascia which widens laterally. Pile yellow on the lateral margins of the apical two segments and genitalia, whole of the first segment, immediate base of the second at the sides and on most of the pale spots on the second segment. Genitalia shining black. Tips of second to fifth segments yellow.

FEMALE.—Front shining black, at the upper third with a broad opaque-black fascia which emits a slender line forward halfway to the base of the antennæ, the sides narrowly white pollinose on the lower two-thirds; pile black, white on the lower orbits; ocellar triangle dull black. Scutellum with a few scattered yellow hairs. Posterior tibiæ reddish on basal third. Abdomen rarely with very small basal reddish spots toward the sides of the third segment, the spots on the second often as in the male, frequently absent, in which case the second segment is metallic blackish blue. The metallic areas are much more extensive than in the male; the third segment is metallic with less than the apical half opaque black, the opaque fascia deeply and triangularly excised in the middle anteriorly and strongly narrowed at the sides; fourth segment with the opaque-black fascia not at all narrowed in the middle and gently narrowed to the lateral margin; fifth segment with the base opaque black, otherwise shining.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, February 18, 1929. Allotype, female, Corozal, C. Z., Jan. 22, 1929. Paratypes: twenty-six males and three females, from Barro Colorado Island and Corozal, Dec. 22, 1928 to February 21, 1929; two males, Fort Davis, Canal Zone, February 9, 1929, (Curran); two males and one female, Chapada, Brazil, November, December, and one male, Rio de Janeiro, November, (Williston Collection); two males, Rio Frio, Magdalena, Colombia, January 9, 1927; female, Tucurinca, Magdalena, January 4, 1927 and female, Sevilla, Colombia, December 18, 1926, (G. Salt); male, Rio Caiary—Uaupes, State of Amazonas, Brazil, 1906, (H. Schmidt); two females, Mt. Duida, Venezuela, November 4, 17, 1928, (G. H. H. Tate).

This species has been confused with *scutellaris* Fabricius but is quite distinct. As a general rule, it is a little more robust and the pale spots appear to be relatively shorter. It seems likely that one of the names placed in the synonymy under *scutellaris* will be found to apply to this species, but it is wholly impossible to reach any conclusions without recourse to the types. Since several of the types are no longer in existence, the names might well be left under *scutellaris*.

Eristalis doris, new species

Related to *conicus* Fabricius but with the disc of the scutellum bearing yellow hair which is more abundant than the black hair of *conicus;* in the female the scutellum is wholly yellow pilose (wholly black pilose in *conicus*). The female most closely approaches *melanaspis* Wiedemann but in that species the broad base and sides of the scutellum bear black pile. Length, 12.5 mm.

MALE.—Head black in ground color; face, cheeks and occiput cinereous pollinose, the sides of the frontal triangle yellowish; pile of face, sides of front and vertex, yellow, of the lower occiput white, of the middle of the front and ocellar triangle, black. A broad median vitta on the lower two-thirds of the face, a triangle on the cheeks anteriorly and the frontal triangle, shining black, the latter with a conspicuous swelling on the middle. Facial tubercle large, elongate oval. Antennæ reddish brown, the arista luteous. Eyes with yellowish pile. Vertical triangle opaque black, in front grayish pollinose.

Mesonotum with two grayish fasciæ in front of the suture, separated from each other by a broad, opaque-black fascia which extends over the posterior third of the humeri. Immediately behind the suture is a broad opaque-black fascia while a similarly colored fascia lies on the broad posterior border, the intervening space being blackish blue and thinly grayish pollinose. Pile short, in front of the suture yellowish, behind black. Pleura grayish pollinose and yellowish pilose, the pteropleura opaque black in front and black pilose. Scutellum pale orange, the basal sixth black, the sides broadly clothed with very dense, short, black pile, the base less thickly black pilose, the remainder with sparse yellow pile.

Coxæ black, gray pollinose; femora shining black; tibiæ reddish, the anterior pair broadly brownish apically; tarsi red, becoming brown apically. Posterior femora strongly incrassate, the inner apex of their tibiæ produced as a very short lappet.

Wings grayish, luteous on basal half in front. Squamæ yellowish, with brown border and brownish yellow fringe. Halteres pale yellow.

Abdomen opaque, black and reddish yellow. First segment wholly black; second reddish yellow with a broad median vitta which is slightly expanded just at its posterior end and is produced narrowly along the anterior margin of the segment halfway to the sides. Third segment with the broad median vitta and posterior third opaque black, the lateral margin obscure brownish. Fourth segment with a broad, moderately interrupted, median fascia which widens laterally, shining blackish blue; apices of the second to fourth segments reddish yellow. Pile yellow, black on apical half of the third and whole of the fourth segment except laterally. Genitalia shining black.

Female.—Front black with steel-blue reflections, above the middle with a broad, opaque black or brown fascia which is more or less distinctly bordered with whitish above and below, the orbits whitish pollinose on the lower half and with white pile. The black pile may have some whitish hairs intermixed on the lower half of the front. Presutural pile mostly pale yellowish. Abdomen metallic blackish blue, the second segment sometimes with reddish yellow spots as in the male: first and second segments with opaque black areas as in the male, the third and fourth with an opaque-black posterior fascia which is rather strongly biconvex in front and occupies little more than the posterior third of the segment at the widest part; fifth segment with the base opaque black.

Types.—Holotype, male, Chapada, Brazil. Allotype, female, Rio de Janeiro, November. Paratype, female, Piedro R., Brazil, April. All are from the Williston Collection.

In *melanaspis* Wiedemann the opaque-black fasciæ on the mesonotum are usually broadly interrupted in the middle and always are in the female of that species, but they are entire in *doris* as is the case in *conicus* Fabricius but this last species has the scutellum black-haired. A careful comparison of the three species reveals many other differences of a comparative nature but the characters enumerated will serve to readily separate the species.

Eristalis mus, new species

Eristalis agrorum Williston, 1888, Trans. Amer. Ent. Soc., XV, p. 280.

Eristalis agrorum Hull, 1925, Ohio Journ. Sci., XXV, p. 289.

Related to *æmulus* Williston but the apical cell is not clouded with gray and the scutellum is black pilose. Mesonotum with three grayish-yellow fasciæ; posterior tibiæ slightly, triangularly produced at apex of posteroventral surface. Length, 13 to 17 mm.

MALE.—Face and sides of front reddish in ground color, and white pilose; median facial vitta reddish or ferruginous; cheeks, front and occiput black, white pollinose, the cheeks bare in front; occipital pile white, becoming yellow at the vertex, a few of the occipital cilia black. Frontal and vertical triangles black-haired, the former broadly shining black in the middle and with a median tubercle, the vertical triangle brownish pollinose. Facial tubercle long and nose-shaped. Antennæ ferruginous, the third segment mostly and the arista reddish. Eyes with tawny or yellow pile above, bare below.

Mesonotum grayish yellow in front of the suture, with a narrow, incomplete opaque-black fascia situated halfway between the suture and anterior margin; the third pale fascia is more grayish and is narrowly separated from the scutellum. Pile yellow, orange on the sides and upper part of the pleura, mostly black on the opaque-black postsutural band. Pleura grayish pollinose and yellow pilose; no black hair on the pteropleura. Scutellum dull yellow, with short, appressed black hair, the very narrow border yellow-haired.

Legs black; coxæ pale pollinose, tips of the femora and bases of tibiæ yellow, the anterior four tibiæ broadly so; tarsi sometimes obscure reddish basally. Posterior femora moderately incrassate; posterior tibiæ slightly produced at apex, their ventral surface ciliate, the dorsal surface not distinctly ciliate, but with more abundant hair than usual.

Wings hyaline, tinged with luteous anteriorly, the marginal and submarginal cells with faint traces of gray cloud. Squamæ brownish, the outer basal corner white; fringe yellowish. Halteres pale yellow.

Abdomen black and reddish yellow, opaque, the lateral margins, fasciæ on third and fourth segments and the genitalia, shining. First segment black, its sides broadly yellow. Second segment yellow with a broad median vitta which tapers posteriorly and is continued very narrowly for some distance along the anterior border of the segment and spreads out posteriorly to form a narrow, posterior fascia which does not quite reach the lateral margins. Third segment yellowish with a broad median vitta which is usually slightly enlarged toward the front and spreads out to form a posterior, laterally tapering black or brown fascia; the segment usually with a broadly interrupted median shining fascia which may, however, be obsolete on the inner portion. Fourth segment black, with a broad, shining black fascia lying a little before the middle. Tips of the second to fourth segments pale yellow. Pile yellowish; black on the broad posterior border of the second and third segments and the opaque part of the fourth, on the sides of the second segment and the sides of the third except basally, the lateral margins, however, at least narrowly pale-haired.

FEMALE.—Front black, broadly reddish above the antennæ; brown pollinose but appearing polished in some lights, the sides broadly white pollinose to above the middle and white pilose, the pile otherwise black. Middle tibiæ sometimes mostly yellow. Posterior black fascia on second abdominal segment scarcely tapering and reaching the lateral margin. The sides of the third segment are black, the pale fascia more broadly interrupted, leaving a posteriorly convex reddish yellow or orange spot on either side; the spots are widest in the middle where they occupy not more than the basal half of the segment, the shining median fascia is very distinct and partly black. Fifth segment shining black with the base broadly opaque.

TYPES.—Holotype, male, Corumbá, Brazil, April. Allotype, female, Chapada, Brazil, December. Paratypes: male and female, Corumbá; four males, two females, Chapada, (Williston Collection); male, Corumbá, Matto Grosso, Dec. 14–23, 1919, (R. G. Harris); male, Yucatan, Mexico, (G. F. Gaumer).

Eristalis spectabilis Hull

HULL, 1925, Ohio Journ. Sci., XXV, p. 289.
Eristalis æmulus HULL (not Williston), 1925, Ohio Journ. Sci., XXV, p. 288.

The type is in the collection of the Museum of Comparative Zoölogy (Johnson Collection) and not in the Curran Collection. Hull failed to associate the two sexes and described the male as *æmulus* Williston, a species he did not have before him at the time of his revision of the genus. Williston's description of *æmulus* is quite accurate and the eyes are only narrowly contiguous in the male.

Eristalis hortorum Fabricius

Syrphus hortorum FABRICIUS, 1775, 'Syst. Ent.,' p. 746.
Musca surinamensis DE GEER, 1775, 'Mem. Hist. Ins.,' VI, p. 145, Pl. xxix, fig. 1.
Eristalis hortorum WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 169.
Eristalis hortorum HULL, 1925, Ohio Journ. Sci , XXV, p. 41.

Hull has redescribed the species and figured the female. The fifth abdominal segment is reddish-brown pollinose apically. There is a female from St. Thomas in the Winthem Collection. The wings are brown on the apical half in front of the fifth vein to a little beyond the end of the first basal cell, thence the brown color is limited behind by a line drawn from the posterior corner of the first basal cell to the tip of the apical cell, thus leaving the tip of the wing and very broad posterior margin clear hyaline. Squamæ yellowish with brownish border, the lower lobe with yellow fringe. The posterior tibiæ bear a rather strong blackish spur on the inner apex and a smaller posterior one. The longish pile on the dorsal and ventral surfaces of the posterior tibiæ is mixed black and yellow except on the yellowish base where it is all pale yellow.

Eristalis amazon, new species

Evidently related to *inversus* Wiedemann but the tibiæ are broadly reddish basally. Wings yellowish brown, the apical and posterior borders cinereous hyaline. Length, 14.5 mm.

FEMALE.—Face yellow in ground color, an incomplete, broad median vitta yellowish brown. Face whitish pollinose and pilose, the sides of the front on the lower two-thirds very narrowly grayish; occiput whitish pollinose, the pile with a yellowish tinge, black above. Front shining black, reddish immediately above the antennæ, the pile short and black; a tubercle above the lunula. Cheeks broadly black in front.

Facial tubercle elongate oval, prominent. Antennæ reddish brown. Eyes with extremely short yellowish hair above.

Mesonotum opaque black, with a narrow brown fascia on the anterior margin and a moderately broad gray one immediately in front of the suture. Pile black, short, longer and yellow in front of the suture except on the anterior margin. Pleura gray, yellow pilose. Scutellum dull yellowish, with short black hair, the border with some longer yellow hair.

Legs black; coxæ gray pollinose; apices of femora reddish yellow; anterior four tibiæ brownish with the basal third or more reddish yellow; posterior tibiæ with the basal fifth reddish yellow; basal segment of the middle tarsi reddish. Posterior femora moderately incrassate; posterior tibiæ slightly triangularly produced at apex of posteroventral surface.

Wings yellowish brown, especially along the veins; the apex and posterior border, as well as the middle of the cells on the apical half of the wing, cinereous hyaline. Squamæ yellowish, with brown border and short yellowish fringe. Halteres yellow.

Abdomen black, mostly opaque, the second segment with a pair of very large reddish spots. First segment black, with the sides broadly red. Second segment reddish, a median vitta which widens anteriorly and posteriorly, extending as a slender fascia along the base of the segment and as a very broad, laterally tapering fascia before the posterior border, opaque black. Tip of second and following segments pale yellow. Third and fourth segments each with a broad, entire shining-black fascia lying mostly before the middle of the segment and expanded laterally to occupy the segment in its full length. Fifth segment shining black with the base broadly opaque. Pile short, black; yellow on the first segment, entire lateral border, and extending well onto the dorsum on the shining fasciæ.

TYPES.—Holotype, female, Rio Caiary-Uaupes, State of Amazonas, Brazil, 1906, (H. Schmidt); paratype, female, Mt. Duida, Venezuela, October 14, 1928, (G. H. H. Tate).

This species approaches the description of *inversus* Wiedemann much more closely than any I have seen but the color of the legs excludes it from that species. It is more robust than any of the other species related to *scutellaris* Fabricius.

Eristalis inversus Wiedemann

WIEDEMANN, 1830. 'Ausser. Zweifl.,' II, p. 161.

A specimen in the Vienna Museum determined, evidently by Wiedemann, as *inversus* is the same as *spectabilis* Hull. However, it seems certain that this is not *inversus* because Wiedemann states that the wings are brown with the apex and posterior border hyaline and the legs wholly black. The species described in this paper as *amazon* apparently approaches *inversus* closer than any other species I have seen but it has the legs partly yellow. The type of *inversus* is in the Frankfort Museum and will have to be examined before the position of the species can be determined. Wiedemann states that it is related to *scutellaris* Fabricius.

Eristalis tenax campestris Meigen

Eristalis campestris MEIGEN, 1822, 'Syst. Beschr.,' III, p. 387.

Eristalis sinensis WIEDEMANN, 1824, 'Anal. Ent.,' p. 37; 1830, 'Ausser Zweifl.,' II, p. 179.

A male from China contained in the Winthem Collection is obviously this form, differing from typical *tenax* in having the posterior femora broadly reddish at the base. It is common in the warmer portions of the world and occurs in North America. I have before me specimens from China, India, Chile, British Columbia, California and northern Africa.

The arista is long pubescent and not bare as has been stated.

Eristalis niger Wiedemann

WIEDEMANN, 1824, 'Anal. Ent.,' p. 38; 1830, 'Ausser. Zweifl.,' II, p. 183.

CURRAN, 1928, Journ. Fed. Malay States Mus., XIV, p. 303.

The type is a female from Java and is in good condition. I have a female from Perak which agrees excellently with the type but the shining prescutellar band and the apical half of the scutellum are metallic deep blue instead of black, and the presutural cinereous band is more distinct. I am not certain that de Meijere had *E. niger* before him (see 'Stud. Sud. Asiat. Dipt.,' III, Tijd. v. Ent., 1908) as he states in his table of species that the scutellum is yellow, whereas it is wholly dark. Otherwise de Meijere's description agrees.

Lathyrophthalmus obliquus Wiedemann

Eristalis obliquus WIEDEMANN, 1829, 'Anal. Ent.,' p. 38; 1830, 'Ausser. Zweifl.,' II, p. 187.

Eristalis obliquus DE MEIJERE, 1908, Tijd. v. Ent., LI, 249, (figs.).

?*L. connectens* HERVÉ-BAZIN, Ann. Sc. Nat. Bot. et Zool., (10) V, p. 19.

The type of this species is a male from Java. The figure of *L. connectens* as given by Hervé-Bazin (*loc. cit.*) would serve as an excellent illustration of the type. The type traces out to *connectens* in the table of species given by Hervé-Bazin. While I have not seen specimens of *connectens* named by Hervé-Bazin, I feel reasonably certain that at least the male, which must be considered the type of the species, is conspecific with *obliquus*, although the females belong to a different species. I cannot say whether the female illustration of *obliquus* Hervé-Bazin represents this species or whether the females associated with *connectens* belong with the male. Hervé-Bazin based his determination of *obliquus* on the redescription of the species by de Meijere, but judging by de Meijere's figures and description he undoubtedly had *obliquus* before him. It seems likely that *obliquus* Hervé-Bazin represents a different species as his figure of the female is quite different from that of de Meijere. The legs in the type are as described by de Meijere and, in view of this description, there should be no difficulty in recognizing the species.

L. obliquus has been recorded from Java, Malay States, China and India.

Lathyrophthalmus modestus Wiedemann

Helophilus modestus Wiedemann, 1819, Zool. Mag., II, p. 43.
Eristalis modestus Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 165.

A male from Cape of Good Hope is evidently a type, as it bears the word "*modestus*" in Wiedemann's writing, but is from Winthem's Collection. This species is very distinct from all others in the genus on account of the widely separated eyes of the male. The face is entirely grayish pollinose, the pollen becoming yellow on the front, and quite wanting toward the vertex. The pile is wholly pale, except on the posterior legs where it is largely black; that on the thorax reddish yellow or rather tawny. Squamæ and fringe whitish. Fourth abdominal segment with an extremely narrow, partly obsolete pre-median gray fascia and indications of a linear basal one. Bezzi states that there is only the apical band, which is hardly correct, although the other two are but little apparent. He was correct in stating that Adams had *myiotropinus* Speiser before him, and not *analis* Macquart, unless the former is synonymous with the latter (see 'Syrph. Eth. Region,' p. 80, 1915). *L. modestus* male has the posterior trochanters produced below into a strong keel which forms a short but strong apical spur, the crest of the keel being densely clothed with short, stiff black hairs.

Lathyrophthalmus haplops Wiedemann

Eristalis haplops Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 182.

The type is a female. Bezzi left this species in *Eristalis* but the eyes are moderately covered with small round spots and are hairy on the upper fifth only. *L. haplops* traces out in Bezzi's table to section 7, but it disagrees with the diagnosis here in lacking the lateral bare stripes on the face. Face rather strongly conical, a triangle on the cheeks, a facial stripe reaching well above the tubercle and upper third of front, shining black, the head elsewhere pale grayish pollinose but tinged with yellow on upper portion of front. Pile of body pale, on thorax yellowish tinged, only a few black hairs below the hind femora apically; the black portion of the front black-haired. Antennæ black, third segment grayish pollinose; arista reddish. Thorax evenly grayish pollinose. Second abdominal segment with a very broad reddish median fascia which is narrowed toward the middle where it is very narrowly interrupted, at the sides occupying the whole length of the segment, leaving a narrow, incomplete basal æneous fascia, and slightly broader, practically entire apical fascia which tapers laterally and is bordered in front by a dull band. Third segment with a sub-basal reddish fascia which reaches the base at the sides and is separated from the base except laterally by about one-third its width, the red ground overlaid by an ashy band. Fourth segment with a very slightly arched basal band, which is separated from the base laterally by a very slender, long triangle and with the apex also broadly ashy, leaving a shining-black median fascia which is narrower than the basal pale one. Fifth segment with the basal fourth ashy, elsewhere shining black.

Megaspis chrysopygus Wiedemann

Eristalis chrysopygus WIEDEMANN, 1819, Zool. Mag., III, p. 15; 1830, 'Ausser. Zweifl.,' II, p. 152.

Megaspis chrysopygus CURRAN, 1928, Journ. Fed. Malay States, XIV, p. 309.

The two specimens, male and female, are from the Winthem Collection and are not types, although at least one of them was determined by Wiedemann. The species has been redescribed by Brunetti in the 'Syrphidæ of India.'

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GEOGRAPHIC VARIATION IN THE AFRICAN SCOPS OWL

BY JAMES P. CHAPIN

The opinion has often been expressed in recent years that *Otus senegalensis* (Swainson)[1] is so extremely variable—within any given area—that it is almost hopeless to attempt to divide it in geographic races. Two island races were admitted by Mr. Sclater,[2] but he did not feel justified in recognizing any of the subdivisions proposed for the birds of the African continent. Dr. Hartert[3] has likewise written: "I doubt if any subspecies of *O. senegalensis* can be separated, and am inclined to believe that *latipennis* . . . , *pygmea* . . . , *ugandæ* . . . , and *hendersoni* . . . are all the same."

A similar conclusion had been arrived at by Claude Grant,[4] who said that individual variation was too great to permit of separating geographic races. He thought there were three phases of plumage: gray, rufous, and slaty-gray. Ogilvie-Grant[5] likewise favored an explanation based upon color-phases.

An examination of the British Museum series might seem to justify such views, for in 1921, when I had an opportunity to study it, scarcely four skins could be found that looked alike in the collection of about fifty. On further investigation, however, it became clear that there was no satisfactory representation from any one locality. A few of the older specimens were without accurate data, or perhaps erroneously labeled; and one became impressed with the need of more extensive collecting. My own field experience leads me to believe that while in some regions the amount of rufous in the plumage must be variable, there are, nevertheless, good grounds for recognizing a number of subspecies. At least, I am sure that within the borders of the Belgian Congo geographic differences are far more pronounced than individual variation. No owls of this species live in the rain forests of the Congo, but they do occur in fair numbers in the savannas of the north, east, and south. Birds from the Uelle District and the Katanga are readily distinguishable.

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[1] *Scops capensis* Smith, 1834, cannot be used as the specific name because in 1837 Smith proposed *Otus capensis* to designate the South African marsh-owl.
[2] 1924, 'Syst. Avium Ethiop.,' part 1, p. 241.
[3] 1924, Novit. Zool., XXXI, p. 18.
[4] 1915, Ibis, pp. 253, 254.
[5] 1912, Ibis, p. 400.

THE NORTHERN CONGO

About Faradje (Upper Uelle District), from 1911 to 1913, I made a special search and secured seven males and a female. In coloration they are all surprisingly alike, allowing for a slight variation in the width of dark streaks on the breast, or the exact amount of rufous in the plumage. None is so light gray as many specimens coming from drier areas of the continent, nor is any prevailingly rufous. In this series there are no color-phases.

These birds from the Uelle answered the description of *O. s. ugandæ* (Neumann): and, when I had the opportunity of comparing a couple of them with Neumann's types in the Berlin Museum, the agreement was found to be close. Since then I have collected two males at Sikiro, near Jinja, Uganda. They are virtually topotypes of *ugandæ*, and fit right in with the small series from Faradje. Three specimens in the British Museum from the intervening area (a pair from Wadelai, and a male from Yei which may be immature) are similar enough to be included in *ugandæ*, as is also a female from Mulema, Ankole. A male in the U. S. National Museum from Rhino Camp, on the Bahr-el-Jebel, may likewise be referred to *ugandæ*, though it has a little more rufous on the middle of crown and back, and a little less dusky vermiculation on breast-feathers, than our skins from the Uelle and Uganda. I have seen no markedly rufous individual from the area mentioned above, and I believe *O. s. ugandæ* to be distinctly stable in coloration.

UPPER GUINEA SAVANNAS AND SUDAN

It is desirable to know, of course, in what way *ugandæ* differs from typical *senegalensis*. Eight skins in the British Museum from Senegal, Gambia, Bathurst, and Accra, average grayer above than *ugandæ*, and rather duller below, the white areas on breast-feathers less conspicuous, yet some of them do show light rufous patches on the breast-feathers. These rufous markings were emphasized in the original description of *ugandæ*, but are perhaps not the most important character. Neither are the types of *ugandæ* so largely rufous as Professor Neumann's description might be taken to indicate. One male specimen of *senegalensis* from the vicinity of Bauchi, Nigeria (B. Alexander), is lighter and grayer than *ugandæ* and lacks distinct rufous marks on the breast. Another, without sex, from Illorin, Nigeria, is more rufous above, with light rufous marks on breast, but has less pronounced dark markings than *ugandæ.* A single male in the Cleveland Museum from Thiés, Senegal, is rather rufous, especially on the middle portion of the breast-feathers, but more generously flecked with white on the upperparts than *ugandæ.* It is evident that in typical *senegalensis* the amount of rufous coloring is variable; but there is no "slaty-gray" phase.

Whether typical *senegalensis* ranges eastward as far as Nigeria and northern Cameroon I shall not attempt to prove. More specimens are needed from small areas before the extent of individual variation can be appreciated. Specimens from the Bahr-el-Ghazal and Sennar are mostly lighter and grayer than *ugandæ.* They seem to be more variable, yet they never quite match the surprisingly stable *ugandæ.*

On the Blue Nile, Phillips and Allen[1] obtained three, of which two are gray and the third markedly rufous. Yet the more reddish individual has about the same black streaking and gray vermiculation as the others. From the same region Madarász (1912) described a very pale gray individual with wing 126 mm. as *Scops konigseggi,* but the name must be synonymous with *Scops pygmea* Brehm (1855) from Sennar. Neither is it sure that *pygmeus* is separable from the Senegal race.

NORTHEASTERN AFRICA

In northeast Africa there seems to be a valid race with very heavy vermiculation. One of the darkest skins I saw in the British Museum—if not the extreme in this direction—was a female from Undel Wells, northern Abyssinia (Jesse). Its crown and back are dark gray with blackish markings, but with very little rufous. Under surface with well-marked black shaft-streaks, and the rest of the exposed portion of the feathers so generously and thickly vermiculated with blackish that the general tone is unusually darkened. Bases of breast-feathers have some light rufous color, but this is almost entirely concealed.

A second specimen of similar color is labeled "Damaraland." This may well be erroneous, as there is no original collector's label, and the bird was acquired by the British Museum from the Tweedale Collection, together with the example from Undel Wells. A third individual with similar vermiculation, but general color not quite so dark, came from the Orr Valley, British East Africa (A. B. Percival).

In the U. S. National Museum there are three heavily vermiculated specimens from Dire Dawa and Sadi Malka, Abyssinia; and a male in the Museum of Comparative Zoölogy, Cambridge, from the Northern

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[1] 1913, Bull. Mus. Comp. Zoöl., LVIII, No. 1, p. 9.

Guaso Nyiro, Kenya Colony (G. M. Allen), is fairly close to the Abyssinian birds. These have recently been described as *O. s. cæcus* by Dr. H. Friedmann; and I am convinced of the validity of this subspecies.

The pair collected by Elliot[1] at Daboije, Somaliland, is of dark color, generously vermiculated, and with light rufous marks on bases of breast-feathers. The male has heavier streaks, above and below, than the female, otherwise they are much alike. Comparison with Dr. Mearns' Abyssinian specimens shows them to be referable to *cæcus*, although not quite so dark as the type of that race.

EASTERN CONGO

Scops owls occur in some of the grasslands along the eastern Congo border, and I have heard them calling at night in the upper Semliki Valley and the Rutshuru Plain. The Congo Museum has a female labeled "Ruzizi-Kivu" which may well be referred to *ugandæ* by its coloration. It seems almost certain that this race extends southward about to Lake Kivu.

At the northern end of Lake Tanganyika, and probably also in the Ruzizi Valley, *O. s. ugandæ* is replaced by another form, of which I have examined four specimens, all from the vicinity of Baraka. Two of these, in the Vienna Museum, collected by Rudolf Grauer, have already been mentioned by Dr. Sassi[2] as differing from the Berlin specimens of *ugandæ* in having less rufous on the underparts, but more cinnamon or rufous color above, so that he thought they might agree with *O. s. pusillus* Gunning and Roberts, of Boror, Portuguese East Africa.

According to the original description, however, and to judge from a specimen from Beira in the British Museum, *pusillus* is a far more rufous race than the birds of Baraka. The Congo Museum also has a specimen collected at Baraka by Pauwels, and I have obtained one at Lueba, just north of Baraka. These four males are all very much alike, and are readily distinguished from both *ugandæ* and *hendersoni*, the latter being known from the Katanga as well as Angola. I shall therefore name them in honor of Rudolf Grauer.

Otus senegalensis graueri, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *O. s. ugandæ*, but the rufous markings on the basal half of breast-feathers paler and less extensive, while the crown, nape, back, rump, and lesser wing-coverts are more heavily washed with rufous. Wing shorter, 127–130 mm.; tail, 58–60 mm.

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[1] 1897, Field Columbian Mus., Ornithology I, No. 2, p. 56.
[2] 1912, Annalen Naturhist. Hofmus., Wien, XXVI, p 361.

TYPE.—Male adult; Lueba on northwest shore of Lake Tanganyika; July 25, 1927; A. M. N. H. No. 262638 Wing, 130 mm.; tail, 58 mm.

It may be expected that the same race will be found in the interior of Tanganyika Territory. A female collected by Loveridge at Morogoro and now in the Museum of Comparative Zoology is very similar in color to specimens of *graueri* from near the type locality, but its wing measures only 119 mm. Other specimens from Tanganyika Territory are grayer.

EASTERN AFRICA

In the highlands of Kenya Colony the African scops owl seems to be relatively scarce. Probably it is more common near the coast, and in northern Tanganyika Territory it is numerous and often heard calling at night. I have not examined many examples from this region, but some of the specimens are decidedly gray. A male in the Berlin Museum from Ukerewe Island, on the southeast side of Lake Victoria, is of a much grayer color than *ugandæ*, especially beneath. A male from the Mkata River, Tanganyika Territory, in the Museum of Comparative Zoology, is unusually light and gray, but may be immature. Another grayish specimen, a male, was taken by Messrs. Rockefeller and Murphy near Mbulu, Tanganyika Territory; and Mr. F. G. Carnochan secured a gray male, with a little more rufous on crown, back, and wing-coverts, 30 miles south of Tabora. These gray specimens from Tanganyika Territory have very whitish tarsal feathering, with only faint streaking. That some rather rufous specimens, resembling *O. s. graueri*, also occur in Tanganyika Territory, has been pointed out above. Whether or not it is simply a case of individual variation remains to be determined. The maximum wing-length in Tanganyika Territory is 130 mm.

SOUTHERN CONGO AND ANGOLA

There is no doubt as to the distinctness of *graueri* from *hendersoni*, which occurs in the Upper Katanga as well as in Angola. The type and cotype of *hendersoni* in the Philadelphia Academy are more uniformly grayish than *ugandæ*, with smaller blackish markings on the upperparts. There are only pale cinnamon markings on the basal part of breast-feathers. There is another specimen in the American Museum collected by Lang at Chitau in central Angola, which agrees with the type of *hendersoni*. The grayer character of *hendersoni* is due largely to fine vermiculation. But it is not such a light gray coloration, nor so much varied with whitish, as in the gray specimens of eastern Africa. A skin in the British Museum from Ndala Tando, Angola (Ansorge), shows the same gray appearance of *hendersoni*. The British Museum has also two skins of Neave's from the Katanga and two from the Loangwa Valley, which are less rufous than *ugandæ*, and are to be referred to *hendersoni*.

Needless to say, I have not been able to make direct comparisons between all these birds, but am writing from notes made by using two of my skins of *ugandæ* as a standard. I believe I have good reason to state that in and near the Belgian Congo *ugandæ*, *graueri*, and *hendersoni* show but little variability and no distinct color-phases.

I do not claim that such is the case for other forms in the Sudan or eastern Africa. I can point out that in some regions, as on the Blue Nile, and possibly Tanganyika Territory—both drier regions than the Congo border—one does find both gray and moderately rufous individuals. More intensive study, on the spot, would be likely to settle their status. It is not to be expected that faunal divisions follow the political boundaries, and it is always possible that in some regions variability in color is greater than in the Congo.

SOUTHERN AFRICA

Claude Grant's remarks may well be considered again, with reference to the races that have been proposed for South Africa. Gunning and Roberts[1] had previously recognized four subspecies in South Africa, three of which they described as new. These Grant regarded as untenable; but he also listed among the supposed races *Otus leucopsis* (Hartlaub) and *Otus icterorhynchus* (Shelley), so it does not seem as though he examined his specimens very critically.

Austin Roberts[2] replied with a strong defense of the four South African races. So far as his material went, twenty specimens in all, the scops owls of a given district were uniformly colored. Of one form, *O. s. intermedius*, he had thirteen examples from the Transvaal. To a certain extent, Mr. Roberts' contention is borne out by material in the British Museum. The type of *Scops capensis* Smith, supposedly from Cape Province, is very dark and brownish on crown, back, and tail, with a light wash of rufous on the tail. Rather broad stripes on breast, but little cross-barring or vermiculation there. This is not unlike the description given by Roberts (1911) for two adults from Grahamstown. I am well aware that there is another old specimen in the British Museum now labeled "Cape of Good Hope" but decidedly rufous in color. Examination of the British Museum register shows, however, that it was originally entered as "*Scops senegalensis*" without locality, so its real origin is doubtful. It is to be regretted that the name *latipennis* must replace *capensis* for this southernmost subdivision of the species.

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[1] 1911, Annals Transvaal Mus., III, p. 111.
[2] 1917, Annals Transvaal Mus., V, p. 247.

From Boror, Portuguese East Africa, Gunning and Roberts described *O. s. pusillus* as "whiter on the abdominal region. . . . general effect gray suffused with fiery yellowish to chestnut; tail gray, washed with rufous. . . . Wing, 127–129." At the British Museum I saw a specimen collected by Claude Grant at Beira, Portuguese East Africa, which was quite exceptional in its light rufous coloration, with wing 126 mm. It must be admitted that this example agrees in color with *pusillus*. On the other hand, Grant's gray specimen from Klein Letaba, Transvaal, may represent *intermedius*, as Roberts claimed. Its wing measured 136 mm.

The lightest gray skin in the British Museum series was from Victoria Falls. Its crown, nevertheless, had good dark streaks, and those on the breast were unusually heavy. Whether this bird should be assigned to *O. s. griseus* Gunning and Roberts, I cannot say; but it may be that similar coloration is the rule in Southwest Africa. Ogilvie-Grant[1] reported a "remarkably gray example" from Lehutitu, in the Kalahari Desert, and a "very similar" specimen procured by C. J. Andersson in Damaraland. As I have already explained, the dark-colored skin in the British Museum labeled Damaraland is of doubtful origin. Pale gray individuals seem to come mainly from the dry areas of Senegal, the Sudan, Tanganyika Territory, and South Africa from Damaraland to the Orange Free State. I do not mean to imply that they all belong to a single race, for I have not been able to make sufficient comparisons.

ISLAND RACES

Subspecies restricted to oceanic islands are likely to receive approval, and it must be said that Count Salvadori took the precaution to have a skin of *O. s. feæ* from Annobon compared with the type of *hendersoni*. The principal characters of *feæ* were its dark color, broad dark stripes on underparts, and smaller light bars or spots on the inner webs of the primaries, toward the base. Wing, 120–125 mm. My examination of a specimen collected by Boyd Alexander confirmed the width of the dark stripes on the breast, but the color of the upperparts was not strikingly different from that of *ugandæ*. *O. s. feæ* must inhabit Annobon in considerable numbers, for Fea collected six specimens in two months. Its peculiarities in color are no greater than those of several mainland races.

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[1] 1912, Ibis, p. 400.

Otus socotranus (Ogilvie-Grant and Forbes), which I have not seen, is listed by Mr. Sclater as a race of the African species. From the original description it must be a light gray race, with very pale underparts, and pale rufous tips to the primaries. The wing-length was given as 127 mm.

VARIATION IN WING-LENGTH

Thus far I have purposely avoided any attempt to justify the recognition of subspecies merely by size. I have taken measurements myself of only about 30 specimens, and it is difficult to gather an adequate series of published data. The extreme dimensions for the species appear to be: wing, 117–143 mm.; tail, 49.5–70 mm. Immature birds may be expected to have shorter wings and tails than adults, and 120 mm. is perhaps the minimum wing-length for an adult. So far as I can determine, there is no appreciable difference in size between the sexes.

Geographic variation in the length of wing is evident, though of course there is some overlapping in measurements. *Otus senegalensis feæ*, according to Salvadori, has the shortest wing, 120–125 mm. *O. s. cæcus* is also short-winged, 121–128 mm. for seven specimens (from Abyssinia. Somaliland, and northern Kenya Colony).

O. s. ugandæ is a large race, with wings in ten specimens 131–143 mm., but it is equalled approximately by *griseus, intermedius,* and *latipennis* of South Africa.

Most of the remaining forms are intermediate in size. The wings of three specimens of *O. s. pusillus* measure 126–129 mm., those of three skins of *graueri* 127–130. In four examples of *hendersoni* the wings vary from 128 to 135 mm., and *O. s. senegalensis* appears to have wings of 123–134 mm. *O. s. pygmeus,* if valid, has similar wing-length, 124–136 mm.

AVAILABLE NAMES

Eighteen names have been proposed, of which perhaps eleven may yet receive recognition. In order of date, they are:

Scops capensis SMITH, 1834, S. Afr. Quart. Journ., 2nd Series, No. 4, part 1, p. 314(South Africa). As explained above, this name cannot be used in the genus *Otus*.

Scops senegalensis SWAINSON, 1837, 'Birds of Western Africa,' I, p. 127 ("Senegal"). This is the oldest name that can be employed for the species. The type came from the Gambia. is in the Cambridge Museum, and has been examined by Dr. Hartert (1913, 'Vögel Paläarkt. Fauna,' II, p. 982, footnote).

Scops latipennis KAUP, 1852, Jardine's 'Contributions to Ornithology,' p. 110 (Caffraria). Said to be like European species, but with coarser markings, and webs of remiges and rectrices broader. Probably this name may be used in place of *capensis* Smith. In 1862, Trans. Zoöl. Soc. London, IV, p. 223, Kaup added that the bars on the inner side of the primaries were very indistinct, and that the outermost primary had traces of four light bars on its inner web basal to the emargination, while there were six white and rufous spots on its outer web. Wing, 140 mm.; tail 67.

Ephialtes hendersoni CASSIN, 1853, Proc. Acad. Nat. Sci. Phila., (1852), p. 186 (off Novo Redondo, Angola). A valid race.

Ephialtes latipennis LICHTENSTEIN, 1854, 'Nomenclator Avium Mus. Zool. Berol.,' p. 7 (Kafferland). No description.

Scops pygmea C. L. BREHM, 1855, 'Der Vollstandige Vogelfang,' p. 43 (Sennar). A race of the African species, according to Dr. Hartert (1918, Novit. Zoöl., XXV, p. 38). The type is in the Tring Museum. Whether or not it is separable from typical *senegalensis* remains to be proved. For the original spelling of *pygmea* I have to rely on Dr. Hartert, for Brehm's book cannot be obtained here. In later years its was often written *pygmæa*.

Strix scops var. *meridionalis* SUNDEVALL, 1857, Kongl. Svenska Vet.-Akad. Handl., II, No. 3, p. 28 (vicinity of Camdebo, S. Afr., ex Levaillant).

Scops fazoglensis WÜRTEMBERG, 1857, Naumannia, p. 432 (*nomen nudum*). Heuglin, 1867, Journ. f. Orn., p. 293, mentions it as a synonym of *S. zorca africana* Schlegel = *S. senegalensis* Swainson.

Scops zorca africanus SCHLEGEL, 1862, 'Mus. Hist. Nat. Pays-Bas, Rev. Méthod. Coll.,' II, Oti, p. 20 (Cape Colony, and Keren in Bogos). Wing, 4 inches 9 lines to 5 inches. Said by Schlegel to be the same as *capensis*, *senegalensis* and *latipennis*.

Scops masauanus HEUGLIN, 1869, 'Orn. Nord-Ost Afr.,' I, p. 117 (*nomen nudum*. Listed only in synonymy of *Scops zorca africana*).

Pisorhina ugandæ NEUMANN, 1899, Journ. f. Orn., p. 56 (Kwa Mtessa, Uganda). A valid race, as explained above.

Scops socotranus OGILVIE-GRANT AND FORBES, 1899, Bull. Liverpool Mus., II, p. 2 (Socotra). Very probably a valid race.

Scops feæ SALVADORI, 1903, Mem. Acc. Torino, (2) LIII, p. 95 (Annobon I.). A valid race.

Pisorhina capensis intermedia GUNNING AND ROBERTS, 1911, Ann. Transv. Mus., III, p. 111 (Pretoria). Almost certainly valid.

Pisorhina capensis grisea GUNNING AND ROBERTS, 1911, Ann. Transv. Mus., III, p. 111 (Bethulie, Orange Free State). May perhaps prove separable.

Pisorhina capensis pusilla GUNNING AND ROBERTS, 1911, Ann. Transv. Mus., III, p. 111 (Namabieda, Boror, Port. E. Afr.). Apparently a valid race, unusually rufous.

Scops königseggi, MADARÁSZ, 1912, Orn. Monatsber., p. 81 (Shemshir, Blue Nile). Supposedly synonymous with *O. s. pygmeus* (Brehm).

Otus senegalensis cæcus FRIEDMANN, 1929, Auk, p. 521 (Sadi Malka, Ethiopia). A well-marked race, of dark coloration.

Otus senegalensis graueri CHAPIN, described in present paper, p. 4.

CONCLUSIONS

While the exact delimitation of ranges is still impossible in many cases, there is good reason to regard the African scops owl as divisible into at least eight geographic races, in addition to the two described from islands. In certain of the drier areas of the continent the amount of

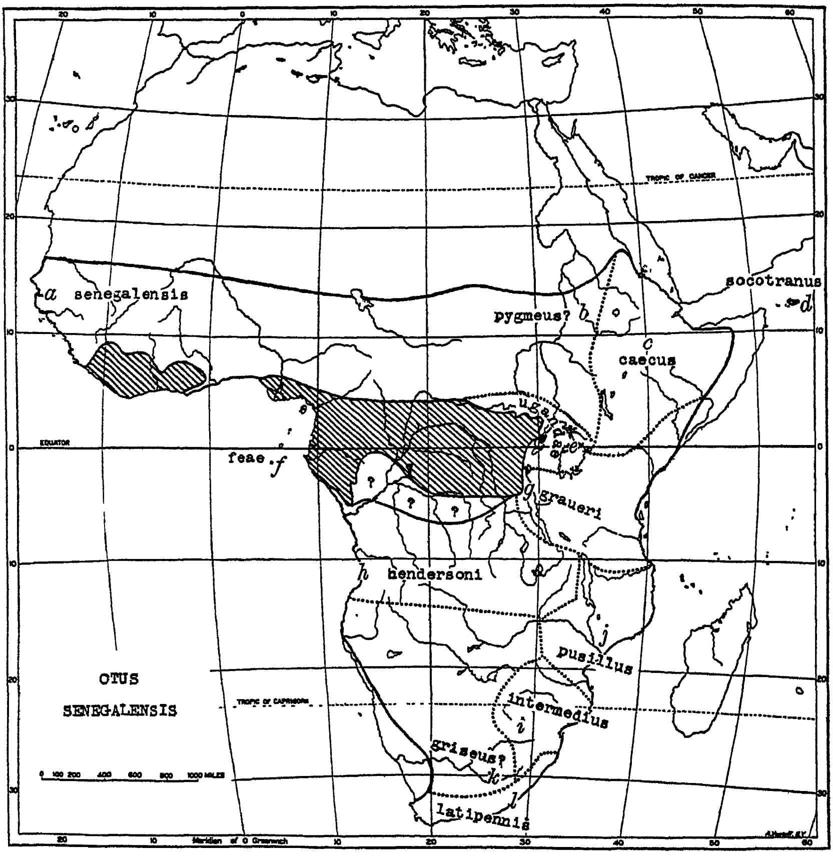

Fig. 1. Distribution of the African scops owl, with possible limits of its races in dotted lines. Type localities of the races which may be recognizable are indicated by letters, as follows: *a*, *senegalensis;* *b*, *pygmeus;* *c*, *cæcus;* *d*, *socotranus;* *e*, *ugandæ;* *f*, *feæ;* *g*, *graueri;* *h*, *hendersoni;* *i*, *intermedius;* *j*, *pusillus;* *k*, *griseus;* *l*, *latipennis.*

The shaded areas represent the heavy forests, in which the species is lacking; and there are no records as yet from the region marked ? ?, just south of the Congo forest. Specimens have been taken, however, at Landana and Kisantu. From the dry coastal areas of Somaliland and Southwest Africa, I can find no records.

rufous in the plumage appears to vary rather widely, but not in such a way as to produce clear-cut phases. In a few other regions the rufous or brownish coloration seems to be constant and characteristic. Wing-length is of assistance in the recognition of races, the longest wings being found in Uganda, the northeastern Congo, and South Africa. The shortest wings are those of the birds of Annobon and northeast Africa.

No museum material which I have seen would indicate that individual variation is as great as geographic variation, although I have personally examined about eighty skins. Our specimens of *ugandæ* from the northeastern Congo and Uganda show surprisingly little variability; and the same is true of the two other races known from the Belgian Congo, as far as available material goes. I venture to predict that some races will be recognizable from single specimens, provided that comparative material is available. Others, being more variable, will require several specimens for determination; but this offers no unusual obstacle in the study of racial subdivision.

The next advance is to be expected from ornithologists in the field who will take pains to gather fair series from a single locality or restricted area. Austin Roberts' method was the right one; while his material of some races was scarcely adequate, the question must be approached in that way. My own experience tends to confirm his statements.

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NEW SPECIES OF VOLUCELLINÆ FROM AMERICA (SYRPHIDÆ, DIPTERA)

BY C. H. CURRAN

In 1926 (Ann. Ent. Soc. Amer., XIX, pp. 50–66), I presented a review of the American species of *Volucella* of which I had seen specimens. Since that time many other species have come to hand and I am now able to extend the scope of that paper and to present a key which, while still far from complete, includes more than thirty additional species. At the same time, I have removed from *Volucella* several species previously included in that genus, and believe the present arrangement will prove much more satisfactory.

KEY TO GENERA

1. Face with three strong tubercles, one on either side of the median tubercle. *Ornidia* St. Fargeau and Serville.
   Face with only one tubercle .... 2.
2. Arista bushy plumose, appearing more or less strap-like .... 3.
   Arista loosely plumose or bare .... 4.
3. Hair of arista all of about the same length and extending to the tip. *Copestylum* Macquart.
   Arista with dorsal and ventral row of longer, isolated rays and with the apex broadly bare .... *Volosyrpha* Shannon.
4. Arista pectinate, with long rays above and extremely short hairs below. *Volucellosia*, new genus.
   Arista plumose or bare, the ventral hairs never imperceptible .... 5.
5. Scutellum basally either with a very strong acute tubercle or with three weak tubercular swellings .... 6.
   Scutellum without tubercles basally .... 7.
6. Scutellum with three rather weak tubercular swellings which bear dense black pile; vertex of female strongly produced upward .. *Apophysophora* Williston.
   Scutellum with a median, strongly produced, acute tubercle. *Viereckomyia* Curran.
7. Apical cross-vein strongly recurrent, strongly bowed outward in its middle ... 8.
   Apical cross-vein transverse or nearly so, at most slightly curved; spurious vein usually absent (Old World) .... *Graptomyza* Wiedemann.
8. Eyes of male widely separated; front much longer than the face. *Megametopon* Giglio-Tos.
   Eyes of male contiguous; front shorter than the face or at most slightly longer. 9.
9. Pile of eyes dense and with scale-like hairs intermixed .... *Lepidopsis* Curran.
   No scale-like hairs on the eyes .... *Volucella* Geoffroy.

MEGAMETOPON Giglio-Tos

GIGLIO-TOS, 1891, Boll. Mus. Zool. Anat. Comp., Torino, VI, No. 108, p. 5.
Ophromyia WILLISTON, 1891, 'Biol. Centr. Amer.,' Dipt., III, p. 55.

In both sexes the antennæ arise near the lower fourth of the eyes, making the front very long. The female in other respects very closely resembles species of *Volucella* Geoffroy but the male has the eyes dichoptic and is very easily recognized. Only one species, *nasicum* Williston, is known.

ORNIDIA St. Fargeau and Serville

ST. FARGEAU AND SERVILLE, 1825, 'Encycl. Method.,' X, p. 786.

This genus was erected for a well-known and widely distributed species and differs from *Volucella* Geoffroy in the presence of strong tubercles on the sides of the face. The known species resemble each other closely and are brilliant green, bluish or cyaneous in color.

GENOTYPE.—*Syrphus obesus* Fabricius.

TABLE OF SPECIES

1. Face and front brownish red, not metallic.. ....*æmula* Williston.
Face and front metallic green to violaceous... . ...2.
2. Femora reddish basally.... ....*obesoides* Giglio-Tos.
Legs wholly black............ . . ..3.
3. With two or four prescutellar bristles; the slight scutellar depression is more or less divided in the middle.................. ....*major*, n. sp.
Without prescutellars; scutellar depression deepest in the middle. *obesa* Fabricius.

Ornidia major, new species

Bright metallic green with blue or violaceous reflections; legs black; wings tinged with luteous, with a transverse brown spot near the middle in front and with a very small one at the apex of the marginal cell. Length, 13 mm.

MALE.—This species is so similar in general appearance to *obesa* Fabricius that a detailed description is unnecessary and a comparison of the two will best serve to differentiate them. *O. major* is larger, the lateral facial tubercle stronger and more oval in outline; third antennal segment much broader; two or four prescutellar bristles; scutellum more transverse apically and with two transverse, preapical depressions which are weakly separated from each other in the middle. The outer forceps of the male genitalia are triangular instead of finger-like and the genitalia are otherwise markedly different.

TYPES.—Holotype, male, "Brazil"; paratype, male, Los Paulo, Brazil.

In size this species is about the same as *æmula* Williston and I had it identified as that species, but in *æmula* the face and front are deep reddish and the spot at the apex of the marginal cell is very much larger than in any of the others.

COPESTYLUM Macquart

MACQUART, 1846, 'Dipt. Exot.,' Suppl. I, p. 124.

Since the publication of my key to the species of *Copestylum* (Ent. News, XXXVIII, p. 43, 1927) another species has come to hand, and the description, drawn up by Dr. Irene Dobroscky, is published here for the first time. The key which follows will separate the known species.

TABLE OF SPECIES

1. Fourth abdominal segment clothed with abundant, erect pale pile, sometimes with coarse black hairs intermixed . . . . . . 2.
   Fourth segment clothed with sparse, coarse, somewhat flattened, subappressed whitish hairs . . . . . . *caudatum* Curran.
2. Wings at most a little darkened, with a blackish spot at the base of the stigma and along the anterior cross-vein . . . . . . 4.
   Wings either with a large median brown cloud or brown in front of the third vein . . . . . . 3.
3. Wings brown in front of third vein . . . . . . *limbipennis* Williston.
   Wings with large, brownish median cloud . . . . . . *salti*, n. sp.
4. Fourth abdominal segment without black hairs; border of scutellum broadly pale-haired . . . . . . 5.
   Fourth segment with coarse black hairs intermixed with the pale pile; venter wholly black . . . . . . *lentum* Williston.
5. Venter black with the narrow lateral border pale; legs black except the base of the tarsi . . . . . . *simile* Giglio-Tos.
   Venter with second and third sternites yellowish, the second sometimes mostly black . . . . . . *marginatum* Say.

Copestylum salti, new species (Dobroscky)

Differs from other species by having a large, brownish, median cloud on the wings, which fades out posteriorly. Length, 10 mm.

MALE.—Face bleached yellowish, a rather broad median vitta, a broad brownish stripe separating the face and cheeks, the cheeks brown with a median and posterior stripe of yellow; the antennal tubercle very dark brown. Vertical triangle black, the posterior orbits narrowly grayish pollinose. Pile yellowish; black on the vertical triangle and forming a broad dense vertical black stripe on the eyes. Antennæ reddish brown, third segment tapering, arista very dark brown, densely short-haired except at base.

Thorax shining black, the lateral margins of the mesonotum, a pair of oval longitudinal prescutellar spots, and the scutellum yellowish. Pile wholly yellowish-white, fine. A large yellow spot on mesopleura above.

Legs mahogany brown; apices of femora and tibiæ, yellow; tarsi yellowish red, apical segment paler. Hair dark brown, ranging to golden brown at tarsi.

Wings hyaline, veins brown; a large brown median cloud. Squamæ and fringe white. Halteres yellow.

Abdomen shining yellow, first segment, median vitta and broad posterior border of second and third segment, and the fourth segment except the broad base, shining black; sides of abdomen rather narrowly blackish, venter yellow, brownish along the middle line; pile pale yellowish, erect on fourth segment.

TYPES.—Holotype, male, paratype, male, Santa Marta, Colombia, July 17, 1927, (G. Salt).

VOLOSYRPHA Shannon

SHANNON, 1929, Ann. Mus. Nac. Hist. Nat., Buenos Aires, XXXIV, p. 575 (a subgenus of *Volucella*).

In addition to the characters mentioned in the key this genus has, on either side of the scutellum, apically, a strong tubercular swelling which is clothed with abundant black hair.

The type of the genus is *Volucella tibialis* Macquart, which was originally described from a single male from Yungas, Brazil. Inasmuch as the third antennal segment was lacking no mention was made of the curious arista and this was not commented upon until 1888, when Williston redescribed the species, placing it in the new genus *Apophysophora*. This genus was distinguished from *Volucella* Geoffroy by the presence of two or three tubercular swellings on the scutellum, and obviously *hirtipes* was intended as the genotype. However, the second species in the genus differs rather markedly from *hirtipes* and lacks the unusual development of the arista. In *hirtipes* the arista is densely short-haired in addition to having long rays above and shorter ones below, while in *scutellata* the arista is of the ordinary plumose type and the scutellum is quite differently shaped. Prior to Williston's mention of *hirtipes*, Bigot had included it in his key to the species of *Phalacromyia*.

The most recent mention of the species is by Shannon in 1929. He evidently overlooked the generic diagnosis of *Apophysophora* Williston or he would not have concluded that his specimen represented an undescribed form. His subgenus, however, should stand as a good genus on the basis of the aristal development and scutellum and may be separated from *Apophysophora* Williston as indicated in the key.

The synonymy of the species is as follows.

Volosyrpha hiritipes Macquart

Volucella hirtipes MACQUART, 1849, 'Dipt. Exot.,' Suppl. IV, p. 130, (f.).

Phalacromyia hirtipes BIGOT, 1883, Ann. Soc. Ent. Fr., III, p. 81.

Apophysophora hirtipes WILLISTON, 1888, Trans. Amer. Ent. Soc., XV, p. 276.

Volucella (*Volosyrpha*) *tibialis* SHANNON, 1929, Ann. Mus. Nac. Hist. Nat., Buenos Aires, XXXIV, p. 575.

I have little doubt about the species described by Shannon being the same as Macquart's species. The color is somewhat variable. One judges from the description that Shannon's specimen was not in perfect condition. Specimens in the Williston Collection agree very well with the description given by Macquart, Williston and Shannon. If the above synonymy should be wrong, a new name will be needed for the form described by Shannon, since Macquart, in 1846, described a *Volucella tibialis* from Mexico

APOPHYSOPHORA Williston

WILLISTON, 1888, Trans. Amer. Ent. Soc., XV, p. 276.

The genus is very characteristic in the female sex, since the vertex is strongly produced upward, but in the male, the only character is the presence of the three tubercles near the base of the scutellum. These are not strong but are sufficiently developed to be readily seen.

The genotype is *Apophysophora scutellata* Williston.

Two species were originally included in this genus, no type being named. Inasmuch as Shannon has made *hirtipes* Macquart the type of *Volosyrpha,* the sole remaining species is *scutellata.* The type series of this species is before me.

VIERECKOMYIA Curran

CURRAN, 1925, Ann. Mag. Nat. Hist., XVI, p. 243.

Only the type species is known. The synonymy is as follows.

Viereckomyia gibbera Schiner

Volucella gibbera SCHINER, 1868, 'Novara Reise,' Dipt., p. 358.

Volucella rospigliosii BRETHES, 1920, Ann. Soc. Cient. Argentine, LXXXIX, p. 31.

CURRAN, 1925, Ann. Mag. Nat. Hist., XVI, p. 243.

A striking, large species, blue and violaceous in color, the wings broadly brownish in front.

VOLUCELLOSIA, new genus

Very similar to *Volucella* Geoffroy and resembling *V. satur* and allies in appearance, but at once distinguished by the long third antennal segment and pectinate arista.

GENOTYPE.—*Volucella fornax* Townsend.

The genus contains only the one species and is very easily recognized.

LEPIDOPSIS Curran

CURRAN, 1925, Ann. Mag. Nat. Hist., XVI, p. 247.

Characterized by the presence of scales among the pile of the eyes. The only known species is *compactus* Curran, described from Brazil.

VOLUCELLA Geoffroy

GEOFFROY, 1764, 'Hist. d'Ins. Env. de Paris,' II, p. 540.
Cenogaster DUMERILL, 1801, 'Zoologie Analitique,' p. 282.
Pterocera MEIGEN, 1803, Illig. Mag. f. Ins., II, p. 275.
Temnocera ST. FARGEAU AND SERVILLE, 1825, 'Encyc. Method.,' X, p. 786.
Phalacromya RONDANI, 1848, in Truqui, 'Studi. Ent.,' I, p. 67, (f.).
Glaurotricha THOMSON, 1869, 'Eugenes Resa,' Dipt., p. 493.
Atemnocera BIGOT, 1882, Bull. Soc. Ent. Fr., p. cxiv.
Camerania GIGLIO-TOS, 1892, Boll. Mus. Zool. Anat. Comp., Torino, VII, No. 117, p. 3.

The type of the genus is *Musca pellucens* Linné. I can find no character for the separation of *Phalacromya* Rondani unless we limit this genus to the species having a depression on the apical part of the scutellum. At first sight it appears that the genus, as here treated, contains a number of segregates which might well be given generic rank but, with the exception of the species falling into *Phalacromya*, the characters intergrade. It is possible that a more comprehensive study of the group will result in the discovery of characters sufficiently well marked to permit of the separation into more than one genus.

TABLE OF SPECIES

1. Scutellum with preapical depression.......................................2.
Scutellum differently shaped, flattened to strongly convex.................21.
2. Face metallic green..3.
Face not metallic green..4.
3. Eyes with dense, short, thickened white pile; cheeks with yellow triangle; tarsi reddish..................................*viridis* Williston.
Eyes with normal cinereous pile; cheeks wholly green; tarsi blackish. *ernesta* Curran.
4. Bristles of the thorax yellow.......................................5.
Bristles of the thorax black..11.
5. Wings with sharply defined, triangular, apical brown spot..*tympanitis* Fabricius.
Wings without sharply defined apical spot..............................6.
6. Squamæ brown or with brown border....................................7.
Squamæ yellowish.........................*pallens* Wiedemann.
7. Mesonotum wholly pale pilose on posterior half..........................8.
Mesonotum broadly black pilose in front of scutellum......................10.
8. Disc of scutellum with coarse black hairs..................*vaga* Wiedemann.
Disc of scutellum with pale hairs only..................................9.
9. Cheeks and face separated by a very broad brownish vitta...*chapadensis*, n. sp.
No brown vitta separating face and cheeks................*brevifacies* Curran.
10. Broad sides of mesonotum yellow pilose on whole length......*brevivittata*, n. sp.
Mesonotum black pilose on full width posteriorly............*musicana*, n. sp.
11. Scutellum without lateral flattened or depressed roughened areas...........12.
Scutellum with lateral flattened or depressed roughened areas..............19.

12. Squamæ or at least the border and fringe brown or black.................13.

Squamæ and fringe yellowish or reddish..................................107.

13. Face wholly black or with a median brown or black stripe..................14.

Face without a median dark vitta; legs brown, the basal segment of the posterior tarsi reddish; cheeks with a slender vitta; face produced strongly downward as a narrow cone; thorax rusty brown, the mesonotum violaceous on the disc; scutellum wholly black pilose.....................105.

14. Legs wholly black..15.

Coxæ yellow or the legs otherwise pale.............................16.

15. Sides of face very broadly yellow........................*vierecki* Curran.

Face black with a narrow whitish pollinose strip on either side below. *cinctiventris*, n. sp.

16. Thorax wholly pale, the dorsum black-haired; scutellum with large, roundish black spot covering most of its surface..................*discalis* Curran.

Thorax largely dark or practically all pale-haired; scutellum differently colored..17.

17. Scutellum with yellow base and apex; facial vitta broad and reaching the antennæ; front of female usually pale except above.......................18.

Scutellum wholly violaceous; facial vitta narrow, not nearly reaching base of antennæ; front black..*fracta* Curran.

18. Pteropleura black-haired; mesonotum narrowly yellow behind the suture. *musana*, n. sp.

Pleura wholly yellow pilose; mesonotum very broadly yellow behind the suture. *mus* Williston.

19. Lateral depressions on scutellum as long as wide........*tricincta* Bigot.

Lateral depressions on scutellum decidedly transverse.....................20.

20. Fourth abdominal segment entirely pale; ferruginous species with narrow black apices to the abdominal segments.................*chalybescens* Wiedemann.

Fourth segment black or bordered with black...........................106.

21. With a prescutellar row of bristles or at least a pair of short, spinous bristles..22.

Without clearly differentiated prescutellar bristles..........................59.

22. Marginal cell much broadened before its tip and always closed..............23.

Marginal cell scarcely widened apically, sometimes open.....................25.

23. Legs black...24.

Legs reddish.......................................*spinigera* Wiedemann.

24. Front yellow pilose; four setigerous tubercles on scutellum. *spinithorax* Arribalzaga.

Front black pilose; six setigerous tubercles on scutellum.....*fulvicornis* Bigot.

25. Epistoma strongly projecting forward and acutely conical; face scarcely produced downward..26.

Face, if produced forward also considerably produced downward.............29.

26. Third antennal segment kidney-shaped................................27.

Third antennal segment very slightly concave above...............*pica* Schiner.

27. Third and fourth abdominal segments wholly black..........*pubescens* Loew.

Third and fourth abdominal segments mostly reddish.......................28.

28. Front of female less than three times as wide as ocellar triangle (Jamaica). *intona* Curran.

Front of female at least four times as wide as ocellar triangle...*haagii* Jænnicke.

29. Face with dark median vitta or wholly dark............................30.

Middle of face wholly pale, at most the sides and cheeks blackish or brown..33.

30. Face and front steel-blue; body chalybeus or metallic greenish blue; wings with quadrate black spot in middle anteriorly ....*azurea* Philippi.

Face pale brown or with median blackish vitta... ... .31.

31. Mesonotum with a rectangular, yellow prescutellar spot; pleura with soft, whitish pile................................*isabellina* Williston.

Mesonotum with a geminate prescutellar yellow spot or not yellow posteriorly............. ....32.

32. Mesonotum with prescutellar geminate yellow spot; tibiæ reddish basally; second abdominal segment pale yellow........ ....*comastes* Williston.

Mesonotum greenish cyaneous; legs wholly black; second abdominal segment yellow with black apex and median vitta, the following segments usually with laterally widened, broad, basal reddish fascia......*macquarti* Curran.

33. Wings without sharply defined brown spots, sometimes delicately infuscate anteriorly or along the veins.... ....34.

Wings with one or more sharply defined brown spots... ....49.

34. Abdomen wholly metallic green; no dark anterior vitta on cheeks; legs reddish, the femora chiefly black above; squamæ thick, the fringe short, rusty reddish; wings hyaline with brown stigmal spot.. ....*barei* Curran.

Differently colored species......... ....35.

35. Abdomen deep violet, the base light yellow; wings infuscate; head broad, the face produced acutely downward..................*amethistina* Bigot.

Abdomen differently colored or otherwise different......................36.

36. Scutellum armed with six or eight strong, setigerous tubercles; large, blackish species with rusty brown scutellum; face reddish yellow, the oral margin narrowly black..37.

Scutellum rarely with setigerous tubercles (if so the abdomen pale in color), although the bristles may arise from a slightly raised base.............38.

37. Cheeks black behind.................... . ...*scutellata* Macquart.

Cheeks wholly reddish or yellowish ... .99.

38. Head very large, inflated; no distinct facial tubercle, the face carried straight downward into a narrow, acute cone; squamæ white with brown border and fringe; thorax with soft white pile and black hair intermixed......39.

Head not unusually large; facial tubercle present......................40.

39. Basal three sternites wholly pale........................*escomelli* Curran.

Second and third sternites bearing large black triangles... ..*concinna* Philippi.

40. Abdomen brownish black, shining; thorax cobalt-blue; legs castaneous; frontal triangle black pilose......................*chætophora* Williston.

Abdomen not wholly black, if so the frontal triangle pale pilose.............41.

41. Squamæ white, the outer half of the lower lobe yellowish and very much thickened..*vesiculosa* Fabricius.

Squamæ differently colored and not thickened ....42.

42. Squamæ with yellow border and fringe..................................43.

Squamæ with black border and fringe; abdomen black, the second and third segments usually largely yellow....................................45.

43. Third and fourth abdominal segments with the basal third yellow pilose.....44.

Third and fourth abdominal segments black pilose........*dorsalis* Wiedemann.

44. Scutellum yellow.......... *prescutellaris* Williston.

Scutellum shining black.......... *Megametopon nasicum* Williston.

45. Wings wholly hyaline.......... *vitripennis* Curran.

Wings conspicuously infuscated, at least on the anterior part..........46.

46. Scutellum wholly yellow..........47.

Scutellum black or brown on apical third or more..........48.

47. Sides of facial tubercle and of the mesonotum behind the suture, yellow pilose. *persimilis* Williston.

Facial tubercle wholly black-haired; sides of mesonotum posteriorly with very little yellow pile.......... *fuscipennis* Macquart.

48. Scutellum wholly blackish.......... *panamensis,* n. sp.

Scutellum broadly reddish basally, at least in the middle .. *correcta* Curran.

49. Scutellum with twenty setigerous tubercles on the margin; abdomen rusty reddish.......... *cockerelli* Curran.

Not more than eight setigerous tubercles; abdomen not wholly reddish.. 50.

50. Pleura with soft, whitish pile..........51.

Pleura with coarse pile or hair..........52.

51. Costal border brown on apical half in front of third vein.. .*megacephala* Loew.

Costal border not brown on apical half.......... *macrocephala* Giglio-Tos.

52. Abdomen entirely pale yellow; thorax rusty yellow.. .. *unicolor* Curran.

Abdomen not entirely yellow, at least fasciate with black.......... 53.

53. Scutellum with six or eight strong, setigerous tubercles (cf. couplet 37). *scutellata* Macquart.

Scutellum without strong tubercles..........54.

54. Legs wholly black..........55.

Legs partly pale-colored..........56.

55. Wings very strongly brownish apically, clouded along the veins.. *alcedo* Curran.

Wings evenly very pale brownish apically in front, not clouded along the veins. *meretricias* Williston.

56. Abdomen yellow with very narrow black segmental apices; scutellum yellow above, flattened before its tips.......... *opinator* Williston.

Abdomen differently colored..........57.

57. Squamæ whitish, the outer half of the lower lobe orange, much thickened; fringe pale.......... *vesiculosa* Fabricius.

Squamal fringe blackish..........58.

58. Face very strongly produced downward; plumula brown. *cyanescens* Macquart.

Face moderately produced downward, rather obtuse; plumula pale yellowish. *macula* Wiedemann.

59. Thorax and abdomen with long, abundant pile, that on the thorax largely yellow..........100.

Thorax and abdomen with shorter, sparser pile, the ground color not concealed..........60.

60. Marginal cell broadened apically, always closed..........61.

Marginal cell scarcely broadened apically, often open..........80.

61. Margin of scutellum with very evident bristles..........62.

Bristles of scutellum scarcely differentiated from the hairs..........68.

62. Face with median black stripe..........63.

Face without median black stripe..........64.

63. Mesonotum thickly yellow pilose . . . . *cæsariata* Williston.
Mesonotum thinly long black pilose . . . . *fraudulenta* Williston.
64. Abdomen yellow with deep black posterior borders to the segments, first segment wholly black, the second with broad median vitta; mesonotum with rectangular prescutellar yellow spot . . . . 65.
Abdomen black and reddish yellow, the colors differently arranged . . . . . . 66.
65. Middle and sides of face black-haired . . . . *tau* Bigot.
Face wholly yellow-haired . . . . *satur* Osten Sacken.
66. Abdomen shining black or castaneous . . . . 67.
Abdomen reddish yellow with blackish markings . . . . *mellea* Jænnicke.
67. Wings hyaline; scutellum weakly tuberculate . . . . *boliviana* Hine.
Wings with large median brown spot in front; scutellum with six strong tubercles.
fulvicornis Bigot.
68. Face perpendicular, not tuberculate; marginal cell not bulbous at apex; wings clouded only on the cross-veins near the middle . . . . 69.
Face concave above; wings with brown bands apically, the apex of the marginal cell bulbous . . . . 74.
69. Mesopleura with a large, oval whitish spot behind . . . . 70.
Mesopleura wholly blackish; arista twice as long as third antennal segment.
avida Osten Sacken.
70. Wings with a large, quadrate brown spot near the middle anteriorly, brownish yellow on the basal half . . . . *quadrata* Williston.
Only the median cross-veins clouded with brown . . . . 71.
71. Face with a narrow brownish or blackish vitta . . . . 72.
Face without median vitta . . . . 73.
72. Abdomen with median black vitta . . . . *lutzi*, n. sp.
Abdomen without median black vitta . . . . *isabellina* Williston.
73. Fourth abdominal segment wholly black . . . . *clarki*, n. sp.
Fourth abdominal segment yellow on basal half . . . . *sternalis*, n. sp.
74. Mesopleura with a whitish yellow spot above . . . . 75.
Mesopleura wholly blackish . . . . 79.
75. Yellow spot on sternopleura, hypopleura, and metapleura . . *fasciata* Macquart.
No pale spots on metapleura and sternopleura . . . . 76.
76. Second abdominal segment wholly pale in front; posterior femora yellow on basal half . . . . *picta* Wiedemann.
Second segment black with crescentric yellow spot . . . . 77.
77. Legs reddish, the tarsi paler basally . . . . 78.
Legs black, the basal two tarsal segments yellow . . . . *pusilla* Macquart.
78. Scutellum yellow pilose . . . . *imitans* Curran.
Scutellum with dense black pile on apical half . . . . *timberlakei* Curran.
79. Scutellum thickly reddish yellow pilose . . . . 98.
Scutellum chiefly black pilose . . . . *unipunctata* Curran.
80. Abdomen unicolorous or practically so . . . . 81.
Abdomen with the base broadly yellow or banded with reddish yellow . . . . 92.
81. Abdomen not metallic green . . . . 82.
Abdomen metallic green; small species . . . . *barei* Curran.
82. Abdomen violaceous . . . . 83.
Abdomen not strongly violaceous . . . . 88.

83. Face pale yellow; cheeks black; front yellow pilose ....84.
Face rusty red to black; wings blackish on basal half in front or brownish on apical half or more ....85.
84. Scutellum pale yellow; only the veins near the middle of the wing clouded with luteous .... *abdominalis* Wiedemann.
Scutellum rusty reddish or brownish; wings luteous between the base and the rectangular median brownish cloud .... *eugenia* Williston.
85. Wings hyaline on apical half, blackish on basal half in front; face with a low, large tubercle; marginal cell closed .... *mexicana* Macquart.
Wings wholly more or less brown; face produced forward below ....86.
86. Antennæ bright red; marginal cell open. .... *nigripes* Bigot.
Antennæ black or brown ....87.
87. Marginal cell open .... *tatei*, n. sp.
Marginal cell petiolate .... *duida*, n. sp.
88. Basal half of wings blackish or dark brown on the anterior half; large, broad species .... *esuriens* Fabricius.
Wings variable in color, but not as above ....89.
89. Wings wholly hyaline, the base but little brownish; cross-veins never darkened. *comstocki* Williston.
Cross-veins clouded or the wings extensively pale brownish ....90.
90. Wings wholly brownish .... *duida*, n. sp.
Wings not wholly brownish ....91.
91. Abdomen castaneous with slight purplish reflections; cross-veins clouded. *postica* Say.
Abdomen deep black; only the anterior cross-vein clouded; subcostal cell and base of wing brownish .... *anna* Williston.
92. Wings with small brownish spots on apex of marginal cell and on apical cross-veins .... *satur* Osten Sacken.
Wings either clouded apically in front or hyaline beyond the stigma .... 93.
93. Epistoma produced as a long, porrect snout .... *pica* Schiner.
Epistoma not snout-like ....94.
94. Face with pale brown or blackish median vitta ....95.
Face wholly yellow .... *yura*, n. sp.
95. Basal abdominal segment black; each segment with a broad, more or less interrupted posterior black fascia .... *isabellina* Williston.
First abdominal segment, basal half of second and transverse spots on third and fourth segments yellowish or reddish. ....96.
96. Tibiæ reddish ....97.
Tibiæ black .... *lugens* Wiedemann.
97. Front of female yellow; pile on basal half of femora mostly yellowish. *vagoides* Curran.
Front of female blackish; hair of legs all black .... *correcta* Curran.
98. Mesonotum wholly reddish yellow pilose .... *ornata* Williston.
Mesonotum largely black pilose .... *pulchripes* Bigot.
99. Face wholly black-haired .... *bradleyi* Curran.
Face yellow-haired on either side of lowest third .... *aricia*, n. sp.
100. Face yellow in ground color ....101.
Face brown or black ....103.

101. Third abdominal segment with a pair of large, sometimes confluent, reddish spots . . . . *bombylans rufomaculata* Jones.
Third segment black in ground color . . . . 102.
102. Thorax in part, at least the scutellum yellow pilose . . *bombylans plumata* De Geer.
Thorax and scutellum wholly black pilose (Europe). . . . *bombylans* Linné.
103. Antennæ reddish . . . . 104.
Antennæ dark brown . . . . *bombylans arctica* Johnson.
104. Abdomen wholly black pilose beyond the second segment.
bombylans americana Johnson.
Fourth segment with tawny pilose band . . . . *bombylans evecta* Walker.
105. Eyes black pilose . . . . *johnsoni* Curran.
Eyes white pilose . . . . *salti*, n. sp.
106. Fourth abdominal segment wholly white pilose . . . . *deceptor* Curran.
Fourth abdominal segment white pilose only on the broad sides and extreme apex.
salti, n. sp.
107. Mesonotum wholly pale . . . . *punctifera* Bigot.
Mesonotum broadly black in front and in the middle. . . . . *corumbensis*, n. sp.

Volucella salti, new species

Related to *deceptor* Curran and *johnsoni* Curran. Differs from *johnsoni* in having the eyes white pilose and from *deceptor* in the absence of lateral scutellar depressions in the male and much more extensive black pile in both sexes. Length, 7 to 8 mm.

MALE.—Face translucent brownish yellow, a narrow vitta separating the face and cheeks and the cheeks posteriorly, reddish brown; frontal triangle brown; occiput black, densely gray pollinose; vertical triangle small, black. Pile of head pale yellowish, sparse. Face produced downward and forward, rather acute, the upper part deeply concave and whitish pollinose above, the tubercle prominent. Antennæ reddish; third segment excised above beyond the middle; arista with black rays and apex.

Thorax reddish brown, the dorsum appearing violaceous or cyaneous, under magnification with four darker vittæ, the scutellar depression brown. Pile black or brown, in the vicinity of the humeri, yellow. Middle of scutellum sometimes reddish brown. Bristles black, rather weak on the scutellum.

Legs black, black-haired; apices of femora and basal segment of posterior four tarsi reddish; pile black.

Wings tinged with yellow, especially apically and in front; stigmal spot small, brown. Squamæ brownish; halteres reddish yellow.

Abdomen blackish, the base broadly and irregular, variable fasciæ on the third and fourth segments, brownish red. Pile black; whitish on the basal two segments except toward either side of the second posteriorly.

FEMALE.—Front rather wide, shining black, with sparse white hair, the hair on the upper part and the occipital cilia black. Mesonotum usually more extensively brownish red. Abdomen shining black, the second segment usually with a pair of brownish-red spots on the basal half, the reddish fasciæ on the apical segments rarely indicated. Second segment black pilose on whole width posteriorly, the sides and apex of the fourth and the whole of the fifth, white pilose.

TYPES.—Three males and seven females, Rio Frio, Magdalena, Colombia, July 18, 20, 25, 26 and 27, 1927, (G. Salt). The holotype, male, and allotype, female, were taken on July 27 and 25, respectively.

This species is unusual in that the female possesses transverse lateral depressions on the scutellum while the male lacks them.

Volucella chalybescens Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 204.

Dr. Salt collected a single male of this species at Rio Frio, Magdalena, Colombia, on July 12, 1927.

Volucella deceptor Curran

Figure 1

Volucella fuscipennis Williston, 1888, Trans. Amer. Ent. Soc., XV, p. 276, (not Macquart).

Phalacromyia deceptor Curran, 1925, Ann. Mag. Nat. Hist., XVI, p. 248.

Williston mentioned two male specimens from Chapada, Brazil, but the collection contains a male and female, the former badly damaged. The species is very similar to *salti*, n. sp., but paler and the male has lateral depressions on the scutellum. The true *fuscipennis* Macquart is related to *persimilis* Williston and closely resembles it superficially.

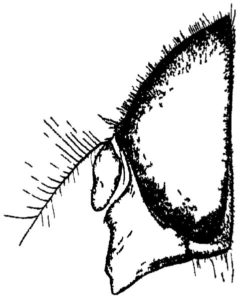

Fig. 1. *Volucella deceptor* Curran. Profile of head of male.

Volucella tricincta Bigot

Bigot, 1875, Ann Soc Ent. France, V, p. 477.

Volucella purpurifera Bigot, 1875, Ann. Soc. Ent France, V, p. 477.

Volucella varians Bigot, 1875, Ann. Soc. Ent. France, V, p. 781.

Volucella fuscipennis Williston, 1891, 'Biol. Centr. Amer.,' Dipt., III, p. 54, (not Macquart).

This species is rather variable in color and a series of thirty specimens taken at Brownsville, Texas, January 2–13, 1928, by H. F. Schwarz, is much duller than any others examined. As a rule, the specimens are rather polished. However, the large lateral depressions on the scutellum render the species easily identifiable.

Volucella fuscipennis Macquart has not, so far as I know, been taken in North America and the name should be dropped from the record.

Volucella chapadensis, new species

Related to *vaga* Wiedemann but distinguished by the wholly yellow pilose scutellum, wider front in the female and somewhat shorter face. Length, about 9 mm.

Female.—Head shining reddish-yellow, a very broad stripe separating the face and cheeks, an incomplete stripe on the middle of the cheeks and the occiput, black; a broad band of whitish pollen below the antennæ; occiput densely cinereous pollinose. Front blackish behind the ocelli, gradually widening from vertex to anterior margin. Pile pale yellowish, sparse on face and front, black only behind the ocelli. Face deeply concave above, the large tubercle as prominent as the antennal base. Antennæ yellowish, the arista with long black rays and apex, the third segment tapering from near the base.

Thorax reddish yellow, the median third or more of the mesonotum, a spot above the posterior coxæ and the scutellar depression black. Pile and bristles pale yellowish, the scutellar depression with inconspicuous black pile.

Coxæ and femora reddish yellow and yellow pilose, the apices of the femora more or less distinctly brownish; tibiæ and tarsi black in ground color, black-haired, the base of the tarsi somewhat reddish.

Wings cinereous hyaline, the apical third tinged with brown; a black spot at base of stigma. Squamæ brown; halteres yellow.

Abdomen rusty reddish-yellow or greenish yellow, the apices of the second and following segments broadly black, the base of the third segment narrowly black except laterally, the black fasciæ on the second and third segments not reaching the lateral margins. Pile short, black, yellow in front of the first black band, on the lateral margins and on the broad base of the fourth segment. Fifth segment wholly black. Venter wholly yellow.

Male.—Frontal triangle small, yellowish, yellow pilose. Pile of thorax erect, not appearing silky from anterior view; abdomen black pilose beyond the apical fourth of the second segment.

Types.—Holotype, female, and allotype, male, Chapada, Brazil, (Williston Collection). The lower edge of the mouth of the male has been eaten by pests, but otherwise the specimen is in excellent condition.

This species looks very much like *vaga* Wiedemann but the thorax lacks the silky appearance when seen from in front and it is a smaller species. It differs from *brevifacies* Curran in having the face more produced downward and in having a broad brown stripe separating the face and cheeks.

Volucella vaga Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 205.

Volucella musta Williston, 1888, Trans. Amer. Ent. Soc., XV, p. 274.

Since the publication of my notes on the type of *vaga* I have examined the type series of *musta* Williston and find that the specimens, all males, agree with the specimen compared with the type of *vaga*. The species I had determined as *musta* I now describe as *musicana*, n. sp.

Volucella brevivittata, new species

Related to *vaga* Wiedemann but the mesonotum is black pilose on the median third, the median black mesonotal vitta is much narrower and does not reach the scutellum, etc. Length, 9 mm.

MALE.—Face and frontal triangle yellow, anterior oral margin, a broad stripe separating the face and cheeks and a narrow stripe on the middle of the cheeks, brown. Occiput black, densely gray pollinose; vertical triangle black, black pilose, the pile of the head yellowish, short and tawny on the eyes. Face deeply concave above, more prominent below than the antennal base, with a strong tubercle, produced moderately downward. Antennæ reddish yellow; rays and apex of the arista brown.

Thorax yellow, vitta occupying the median fourth of the mesonotum, a spot on the sternopleura and another above the posterior coxæ, shining black, the mesonotal vitta not reaching the scutellum; scutellar depression brown. Pile and bristles bright yellow, black on the median third or more of the mesonotum and on the scutellum.

Coxæ and femora yellow; broad apices of the femora brown; tibiæ and tarsi black.

Wings hyaline, with slight yellowish tinge, the apical fourth somewhat gray; stigmal spot small, blackish. Squamæ brown; knob of halteres white.

Abdomen rusty reddish, the base broadly reddish yellow; apex of the second and following segments broadly black, the third and fourth with the lateral margins black and with a median vitta which broadens and is divided in front, that on the third segment obsolete posteriorly. Pile short, black, yellow in front of the black fascia on the second segment and on the venter.

HOLOTYPE.—Male, Chapada, Brazil, (Williston Collection).

Volucella musicana, new species

Volucella punctifera? WILLISTON, 1888, Trans. Amer. Ent. Soc., XV, p. 275.

Related to *vaga* Wiedemann but at once distinguished by having about the posterior third of the mesonotum black-haired, absence of silky sheen and by the absence of black on the mesonotum. Length, 8 to 9 mm.

MALE.—Face and frontal triangle yellowish, a broad stripe separating the face and cheeks and another below the eyes, brown; cheeks reddish, occiput black in ground color, thickly cinereous pollinose; vertical triangle black, black pilose, the pile elsewhere yellowish. Upper half of face deeply concave, whitish pollinose above, the lower half as prominent as the antennal base and with a large, low tubercle, the face produced moderately downward. Antennæ dull orange, the third segment gently tapering from base to apex; arista with brown rays and apex.

Thorax yellow, the mesonotum, except the broad sides rusty reddish, yellow pilose, the posterior third of the mesonotum and the scutellum with black pile, the ventral fringe yellow; scutellar depression black.

Coxæ and femora reddish; tibiæ and tarsi black, the basal tarsal segment reddish.

Wings cinereous hyaline, the apical third gray; stigmal spot black. Squamæ brown; halteres yellow.

Abdomen rusty reddish, the basal two segments reddish yellow; broad apex of second segment, base and broad posterior border of the third and fourth, black, these latter sometimes almost all shining blackish or black with incomplete reddish fasciæ which may be interrupted; black fascia on second segment never reaching the lateral margin. Pile black, yellow on base of abdomen, lateral margins, broad apex of the fourth segment and venter. Genitalia ferruginous.

FEMALE.—Front reddish, moderately wide, gently narrowing to the vertex; pile short, brown. Third and fourth abdominal segments black with a broad, anteriorly concave yellowish fascia; fifth segment black.

TYPES.—Holotype, male, allotype, female, and two paratypes of each sex from Chapada, Brazil, (Williston Collection).

Williston doubted his identification of *punctifera* Bigot and I do not think this could possibly be that species. I have a specimen agreeing quite well with Bigot's description but until the type has been examined the identity of the species must remain in doubt.

Volucella cinctiventris, new species

Related to *vierecki* Curran but the face is black in ground color, with a narrow, tapering reddish vitta on either side of the lower half. Length, 8.5 mm.

FEMALE.—Face shining black, the upper third and a reddish vitta on either side of the lower half, whitish pollinose; lateral oral margin and a stripe on the front of the cheeks, reddish. Face deeply concave above, the lower part level with the base of the antennæ, produced downward, the tubercle low and broad; pile yellowish. Front bluish black, with a conspicuous concavity on the lower third, the sides practically parallel on the upper half; pile pale yellowish, on the lateral depressions abundant and appressed, appearing silvery; the vertex black-haired, the black hairs extending along the middle line to well in front of the ocelli. Occiput densely yellowish pollinose and with yellow pile; no black occipital cilia. Antennæ regular in outline, brownish red, the third segment mostly reddish brown; arista black on apical half, the long rays black.

Thorax metallic greenish black, the mesonotum opalescent; pile short, pale yellowish; humeri yellow. Scutellum reddish yellow, with slight opalescence dorsally, the pile short, appressed, black, the margin with three pairs of black bristles; before the apex a moderately deep, transverse depression; no prescutellar bristles.

Legs blackish, black-haired; tarsi brown; coxæ pale-haired anteriorly.

Wings clouded with pale brown on apical half, with luteous tinge basally; marginal cell open. Squamæ white, with brown border and fringe. Halteres whitish.

Abdomen opalescent green with very strong violaceous reflections, the first segment and basal half of the second laterally, reddish yellow. Pile short, erect, pale cinereous yellowish, the second and following segments toward the sides with some black hair posteriorly.

HOLOTYPE.—Female, Barro Colorado Island, Canal Zone, January 8, 1929, (Curran).

Volucella musana, new species

Related to *mus* Williston but the mesonotum is only narrowly yellow behind the suture and the pteropleura is black-haired. Length, 8 mm.

FEMALE.—Face and cheeks pale orange, brown as follows: a broad median vitta reaching to the base of the antennæ, broad ones separating the face and cheeks and the posterior part of the cheeks; pile yellow, rather sparse. Front pale orange, with an anteriorly broadened median brown vitta on the lower three-fifths, the upper two-fifths shining brownish-black; pile black, yellow on lowest fifth; lateral depressions wide; transverse depression wide and shallow; front widening from vertex to anterior margin. Face rather strongly produced downward, receding from the tip of the low tubercle to the anterior oral margin, concave on more than the upper half, the upper part of the concavity thinly whitish pollinose. Occiput black, thickly cinereous pollinose, pale yellowish pilose, the occipital cilia black. Antennæ orange, regular in outline, the arista brown, with long black rays.

Mesonotum black, overcast with metallic green and with more or less opalescent reflection; broad lateral border in front of the suture, narrow lateral border behind the suture and the posterior border, yellow. Pleura blackish brown, thinly yellowish-brown pollinose; a large rectangular spot beneath the humeri and the posterior half of the mesopleura, yellow; area above the front coxæ and a broad band extending from the squamæ to the middle coxæ, reddish. Scutellum blackish, the narrow base and broad apex reddish yellow, the transverse depression yellow. Scutellar pile brownish, the three pairs of marginal bristles black.

Legs black, the coxæ and femora reddish; pile black, yellow on the coxæ and on basal half of the femora posteriorly.

Wings brownish on apical half, tinged with luteous on basal half. Squamæ yellowish, with brown border and fringe. Knob of halteres white, the stem reddish.

Abdomen shining black, the first segment and basal half of the second yellow; third and fourth segments with a basal transverse reddish spot toward either side. Pile black on the apical half of the second and third segments and almost the whole of the fourth, elsewhere pale yellowish and wholly pale on the lateral margins.

HOLOTYPE.—Female, Barro Colorado Island, Canal Zone, January 7, 1929, (Curran).

Volucella panamensis, new species

Related to *correcta* Curran but the scutellum is wholly dark in ground color. Brown, with greenish opalescence on the mesonotum and scutellum. Length, 8 to 10 mm.

MALE.—Face and cheeks reddish, the former with a broad, obscure blackish vitta on the lower half, the oral angles blackish; a broad band of yellow pollen below the antennæ. Face strongly concave above, below the broad, nose-shaped tubercle a little more prominent than the antennal base, moderately produced downward; pile black. Frontal triangle small, shining black, the upper angle brownish yellow pollinose; at most a few black hairs laterally. Occiput black, cinereous pollinose and yellowish pilose; occipital cilia and hair of the small, black vertical triangle, black. Antennæ brownish red, regular in outline; arista with black rays, the base broadly reddish.

Mesonotum broadly brownish-red laterally, the disc greenish black with strong opalescent reflections, in front of the suture with brownish-gray pollen. Pleura shining reddish and ferruginous. Scutellum with the free border shining brown, the disc dull metallic greenish. Pile wholly black; a row of prescutellar bristles; scutellum with four pairs of marginals.

Legs black; femora reddish, the base and lower surface more or less black. Hair wholly black. Coxæ reddish.

Wings brownish, paler posteriorly, the basal half more luteous or grayish; apical cell petiolate. Squamæ brown, with black border and fringe. Halteres reddish, the knob sulphur-yellow.

Abdomen brown, the first segment and more than the basal half of the second, reddish, the third and fourth on either side each with a large, subtriangular basal reddish spot. Genitalia small, reddish. Pile black except on the first segment and basal two sternites.

Female.—Front shining black, black pilose, the sides gently diverging on the lower three-fourths; in the middle with a shallow, longitudinal groove, the lateral depressions fairly well marked; ocellar triangle near the vertex. Base of abdomen yellow instead of reddish.

Types.—Holotype, male, Barro Colorado Island, Canal Zone, February 13, 1929; allotype, female, same locality, January 28, 1929, (Curran).

Volucella corumbensis, new species

Related to *viridis* Williston but without green coloration; ferruginous reddish with black markings. Length, 7 mm.

Male.—Head reddish, an incomplete stripe separating the face and cheeks and the posterior third of the cheeks, brown; occiput black, densely gray pollinose; front greenish black, almost the upper third, the raised median vitta and the region above the antennæ reddish. Front wide, the lateral depressions wide but not deep, the pile fairly abundant. Face moderately concave on upper half, the tubercle prominent, the lower section of the face as prominent as the antennal base and vertical, the face produced moderately downward. Pile pale yellowish, on the eyes reddish yellow. Antennæ reddish yellow, the long rays and apex of the arista black.

Thorax ferruginous red, in front of the suture and the median third on the anterior two-thirds of the mesonotum, black, the black vitta divided posteriorly; notopleura ferruginous; humeri yellow. Pile pale brassy yellow; bristles black. Scutellar depression well before the apex.

Legs ferruginous, the femora with yellowish apices and generally more reddish; basal segment of the tarsi yellowish. Pile black, long on the tibiæ, yellowish on basal part of the femora.

Wings cinereous hyaline, a little darker apically; stigmal spot small, black. Squamæ and their fringe yellowish. Knob of halteres white.

Abdomen ferruginous red, the base broadly darker, the dark coloration on the second segment divided by a narrow median vitta. Pile short but conspicuous, pale brassy yellow. The abdomen is oval and strongly convex.

Holotype.—Female, Corumba, Brazil, April, (Williston Collection).

Volucella lutzi, new species

Related to *isabellina* Williston but the thorax is much less pollinose, the abdomen bears a median black vitta and the front of the female is broadly pale yellow pilose on the lower half laterally. Differs from *avida* Osten Sacken in having a large pale yellowish spot on the mesopleura. Length, 12 to 12.5 mm.

Male.—Face and front pale yellowish, shining; a narrow median brown vitta extends from the oral margin to the upper fourth of the face and the frontal lunule is brown. Pile of front and middle of face black; on the sides and lower fourth of face, cheeks and occiput, pale yellowish. Cheeks shining brown; occiput brown, densely cinereous white pollinose; vertical triangle brownish red, black pilose. Eyes brown pilose, posteriorly and ventrally with pale yellow pile. Frontal triangle gently convex, prominent; face almost perpendicular, with only slight trace of tubercle, sharply conical below. Antennæ short, brownish; rays of arista black.

Mesonotum shining black, on the anterior half with a pair of broad, pale yellowish pollinose vittæ which are slightly divergent posteriorly; lateral margins broadly and a transverse, rectangular prescutellar spot, pale yellowish. Pleura reddish brown, the mesopleura pale yellowish posteriorly. Pile pale yellowish, crinkly, on the mesonotum and pteropleura with coarser black hairs intermixed. Scutellum translucent reddish yellow, black-haired, the base very narrowly pale-haired. Bristles of thorax hair-like.

Legs brown; tibiæ reddish yellow on about the basal half; hair black.

Wings hyaline; cross-veins at middle of wing narrowly clouded with brown, the costal cell apically and the stigmal cell tinged with luteous; stigmal spot brown. Squamæ white, fringe yellow. Halteres reddish yellow with brown knob.

Abdomen reddish yellow with shining black fasciæ and median vitta. First segment black; second with the base, except laterally, the posterior fifth and a medianly narrowed median vitta, black; third segment with posterior fifth and anteriorly tapering median vitta black. Fourth segment with a broad black fascia on the posterior half which emits a narrow median vitta toward the base of the segment, the anterior half of the segment pale orange. Pile whitish yellow, black on the posterior half of the second and third segments. First sternite brown except the apex; second with a broad basal fascia and the median fifth, brown; third with the posterior border, widening medianly and laterally, blackish. Fourth sternite blackish with a pair of large, narrowly separated basal yellow triangles. Genitalia shining blackish.

FEMALE.—Front wide, pale yellow, reddish yellow above, the ocellar triangle brown; pile black, pale yellowish on the lateral third of more than the lower half; frontal depressions very wide. Black fasciæ on second and third abdominal segments wider than in male; fifth segment black with a reddish triangle extending the whole length in the middle; second sternite wholly pale.

TYPES.—Holotype, male, and allotype, female, Coyote Mountains, Arizona, August 4–7, 1916, altitude about 3,500 ft., (F. E. Lutz); paratype, female, "California," (Wheeler Collection).

Volucella clarki, new species

Related to *isabellina* Williston but without a brown facial vitta and with the apical abdominal segment entirely black. Length, 15 to 17 mm.

MALE.—Head yellow; cheeks and face separated by a brown stripe; occiput black, yellow pollinose; vertical triangle reddish yellow, the ocellar triangle black. Pile of head yellow, the vertical triangle black-haired, the frontal triangle with a few scattered black hairs. Frontal triangle broad, gently convex; face receding on lower fourth, perpendicular above, not tuberculate. Antennæ reddish brown; third segment narrowed on apical half; arista with black rays.

Mesonotum shining black, the anterior two-fifths thinly pale pollinose, in the middle with a pair of broad cinereous vittæ extending from the anterior margin almost to the middle; lateral margins broadly and a broad, subrectangular prescutellar spot, pale yellowish. Pleura reddish brown, the mesopleura mostly and the upper edge of the sternopleura pale yellow. Pile whitish yellow, dense laterally, intermixed with black on the mesonotum. Scutellum translucent reddish yellow, with short, appressed black hair, the margins with longer yellowish pile; no bristles.

Legs blackish, the tibiæ and tarsi brown; basal half or less of the tibiæ and the apices of the femora reddish; hair black.

Wings hyaline; tinged with brown basally, the cross-veins bordered with brown, the stigmal cell brown. Squamæ yellow, with reddish yellow fringe. Halteres reddish brown.

Abdomen yellow and black. First segment black except laterally. Second segment with the posterior fifth and a slender median vitta black. Third segment black on the posterior half laterally, the pale base narrowed in the middle by the triangular projection of the black band. Fourth segment wholly black. First segment wholly and basal two-thirds of second pale yellowish pilose; third segment black pilose with the basal sixth, widening to one-half at the sides, yellow; fourth segment with short black pile and long pale hairs intermixed, the base wholly pale pilose. Sternites black posteriorly, yellow anteriorly, the black covering most of the fourth sternite and leaving anterior, medianly interrupted pale, triangles, the pale areas increasing in extent on each of the preceding sternites, the first wholly black except its apex.

FEMALE.—Front wide, black pilose, the broad lateral depressions with yellow pile; a brownish spot connects the black ocellar triangle and the frontal orbits. Fourth abdominal segment with less pale pile but with more conspicuous pale pile in front toward the sides; fifth segment wholly black and black-haired. Venter similar to male.

TYPES.—Holotype, male, San Xavier, near Tucson, Arizona, July 24, 1916, (F. E. Lutz); allotype, female, San José del Cabo, (Wheeler Collection).

In many respects this species resembles *quadrata* Williston but it differs in having more sharply defined black markings on the abdomen, no pale pile on fifth abdominal segment of female and in having the black band on the second sternite narrowest laterally.

It is with pleasure that I name this fine species in honor of Mr. B. Preston Clark, under whose auspices the 1916 expedition to Arizona was undertaken.

Volucella sternalis, new species

Related to *isabellina* Williston but without a median brown facial vitta. Length, 12.5 mm.

MALE.—Face and front translucent waxy yellow, the frontal triangle broad and strongly convex, black pilose; face black pilose in the middle on the upper half, gently concave on upper fourth, receding on lower fifth; cheeks reddish yellow with broad brown stripe in front. Occiput black, thickly cinereous yellow pollinose, with short, pale yellowish pile. Vertical triangle small, black and black pilose. Eyes with reddish yellow hair. Antennæ reddish, the third segment narrow on apical third; arista with black rays.

Mesonotum shining black, on the anterior half with a pair of broad, grayish pollinose vittæ, the sides broadly and a transverse prescutellar spot, waxy yellow. Pleura brown, the mesopleura mostly yellow. Pile pale yellow, the mesonotum with a broad band of black hair behind the suture. Scutellum translucent waxy yellow, with short, subappressed black hair, the base narrowly yellow pilose.

Legs brown; broad apices of femora and basal half or more of the tibiæ reddish yellow; hair black.

Wings hyaline; cross-veins at middle of wing bordered with brown, the base of the wing brownish along the veins; stigmal cell luteous. Squamæ yellowish, with brown fringe. Halteres brownish, the apex of the knob yellow.

Abdomen yellowish, with brown fasciæ. First segment brown except the sides. Second segment with the posterior border brown, interrupted in the middle and with an anteriorly widened median vitta. Third segment with the posterior fourth produced forward as narrow triangles in the middle and at either side, brown. Fourth segment with a broad, arched brown fascia across the posterior third. Genitalia reddish brown. Pile short, yellow and black; on the second segment the black pile occupies more than the posterior half laterally, and narrows to occupy only the posterior third medianly; third segment with the basal fourth, widening to half at the sides, yellow pilose; fourth segment yellow pilose except on the brown fascia. Second, third and fourth sternites each with a large brown triangle; first sternite mostly brown.

HOLOTYPE.—Male, San José del Cabo, (Wheeler Collection)

Volucella tatei, new species

Black with violaceous and greenish opalescent reflections; oral margin produced strongly forward and downward. Length, 11.5 mm.

FEMALE.—Head black, the face produced below to form a conical snout; sides of face very broadly, a band below the antennæ, occiput and frontal orbits on lower half, cinereous white pollinose. Face and occiput with whitish hair, the latter with some short black hairs toward the vertex. Front shining black, black pilose. Basal two antennal segments black, the third brown, paler basally on under surface; arista reddish basally, with long black rays. Pile of eyes with tawny tinge, becoming brownish above.

Thorax pale pilose, with black hairs intermixed dorsally, the scutellum wholly black-haired and with four pairs of marginal bristles. Mesonotum and scutellum, with the exception of the margins, greenish opalescent. Pleura thinly brown pollinose.

Legs black, black-haired. Wings brown, becoming paler posteriorly; marginal cell open. Squamæ brown. Halteres yellow with white knob.

Abdomen blackish, very strongly violaceous; short cinereous pilose, the apices of the segments black pilose except laterally.

TYPES.—Holotype, female, Mt. Duida, Venezuela, January 16, 1929, (G. H. H. Tate); paratype, another female from the same locality, December 1, 1928.

Volucella duida, new species

Related to *tatei*, new species, but the face is much less produced and bears a long, yellowish triangle on either side. Length, about 11 mm.

FEMALE.—Head black, the face with a yellowish triangle reaching from the orbit to the oral margin, the sides broadly cinereous-white pollinose; orbits densely cinereous pollinose, white pilose, toward the vertex bare and with short black pile.

Front shining black, whitish pollinose along the orbits on the lower half, the pile black. Face below more prominent than the antennal base, produced downward and with a conspicuous tubercle. Antennæ brown; arista reddish on basal third, with black rays of moderate length. Eyes with reddish-brown pile which becomes tawny below.

Thorax black, cinereous-yellow pilose, the pleura, with the exception of the mesopleura, and the scutellum wholly, black-haired; mesonotum with black hairs scattered among the pale pile, especially posteriorly. Scutellum with three pairs of black marginal bristles; no prescutellar row. Mesonotum and scutellum greenish opalescent or violaceous, the margins dull.

Legs black, black-haired. Wings brown, becoming paler behind; marginal cell petiolate, not widened apically. Squamæ brownish. Halteres whitish on apical half, reddish basally.

Abdomen black, more or less bronzed or violaceous; pile short, whitish and black; lateral margins and first segment wholly, basal half of second, a broadly interrupted fascia on the third and the fourth segment except basally, pale pilose.

TYPES.—Six female specimens from Mt. Duida, Venezuela, December 10, 1928, January 11 and 16, 1929, (G. H. H. Tate). The holotype was taken on January 16.

Volucella yura, new species

A peculiar small species, evidently related to the *avida* group, but with a short head and the face unusually produced downward, the abdomen shining metallic-black with opaque fasciæ and reddish spots on the second segment. Length, 9 mm.

FEMALE.—Face shining yellowish, separated from the cheeks by a black vitta, the cheeks black on more than the posterior half; pile soft and whitish; face perpendicular, with a small tubercle below the middle, more than half the face below the lower level of the eyes. Occiput black, gray pollinose behind the eyes, wholly cinereous-white pilose. Front shining metallic-black; the lower sixth concolorous with the face; pile black, the depressions thickly covered with cinereous white pubescent-like pile, thickly punctured and much wider than the median part.

Thorax shining black, cinereous-white pilose, on the mesonotum with longer black hairs intermixed. Scutellum ferruginous, the border blackish. Thorax without bristles.

Legs black; apices of femora and basal two-thirds of the tibiæ reddish; pile black, cinereous white on the femora posteriorly.

Wings hyaline; anterior cross-vein bordered with brown; base of stigma brown. Squamæ whitish yellow; halteres reddish yellow.

Abdomen æneous or bronze-black; second segment with a pair of large, subtriangular reddish-yellow spots, the posterior third opaque black except laterally; third segment with a similar opaque-black fascia. Pile short, longer laterally, cinereous white, black on the opaque-black fasciæ. Venter wholly shining black and with longer, pale pile.

HOLOTYPE.—Female, Yura, Peru, (Dr. E. Escomel).

Volucella aricia, new species

Scutellum with eight setigerous tubercles. Related to *bradleyi* Curran but the broad sides of the face are yellow pilose on the lower third, the facial tubercle is much weaker, etc. Length, 15 mm.

FEMALE.—Head translucent reddish yellow, the occiput black and densely gray pollinose; pile black, on the sides of the face below, lower half of cheeks and the occiput, yellowish. Face perpendicular, the low tubercle about one-third as long as the face; front broad, swollen, with a median groove, the lateral depressions broad. Antennæ reddish, the third segment constricted on apical third; arista black, with long rays. Eyes with reddish-yellow pile.

Mesonotum shining black, pale yellow pilose, with whitish pile forming more or less distinct vittæ and with longer black pile intermixed. Pleura with long, soft, pale yellowish pile, and longer black hairs on the mesopleura. Scutellum translucent brownish red, black-haired, the border with finer pale hair and bearing eight setigerous tubercles and an additional pair of bristles.

Legs black; tibiæ reddish on basal third or more, black-haired.

Wings hyaline; stigmal spot blackish, the stigmal cell luteous. Squamæ yellowish with brown border and yellowish brown fringe. Halteres yellow.

Abdomen shining black, the second segment reddish with the base broadly and a very broad median vitta shining black. Pile black, short, on the first segment, base of second laterally, sides of second and the basal three sternites, cinereous white. Venter wholly shining black.

HOLOTYPE.—Female, foothills west of Mendoza, Argentina, (T. D. A. Cockerell).

Volucella bombylans Linné

Musca bombylans LINNÉ, 1792, 'Syst. Nat.,' 10th Ed., p. 591.

In 1925, Johnson (Psyche, XXXII, p. 114) dealt with the American varieties of *bombylans* recognizing three subspecies and four varieties of these. The species exhibits a large range of variation in color and many varieties have been described. Of the American forms the only one recognized by Johnson and not seen by me is *arctica* Johnson.

From the material before me it seems quite certain that *facialis* Williston and *lateralis* Johnson are both the same as variety *plumata* DeGeer, a very common European form, and I have long considered them the same. In typical *facialis* there is no yellow hair on the mesonotum or pleura, while in *plumata* the sides and usually the anterior and posterior margin of the mesonotum and at least the mesopleura bear yellow pile. Intermediate forms occur. According to a type specimen of *lateralis* before me it is identical with European specimens of *plumata.*

The variety described by Jones as *rufomaculata* is apparently restricted to the Rocky Mountain region and is readily recognized by the characters given in the key.

The dark brown antennæ of the variety *arctica* Johnson distinguish it from *evecta* Walker and *americana* Johnson.

Johnson does not recognize the typical *evecta* of Walker. I think that there can be no doubt that this is the same as *sanguinea* Williston.

The variety *americana* Johnson is a very easily recognized form and rather common in the northern states and Canada.

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STUDIES FROM THE DWIGHT COLLECTION OF GUATEMALA BIRDS. II

By Ludlow Griscom

This is the second[1] preliminary paper, containing descriptions of new forms in the Dwight Collection, or revisions of Central American birds, based almost entirely on material in The American Museum of Natural History. As usual, all measurements are in millimeters, and technical color-terms follow Ridgway's nomenclature. The writer would appreciate prompt criticism from his colleagues, for inclusion in the final report.

Cerchneis sparveria tropicalis, new subspecies

Subspecific Characters.—Similar to typical *Cerchneis sparveria* (Linnæus) of "Carolina," but much smaller and strikingly darker colored above in all ages and both sexes; adult male apparently without rufous crown-patch and only a faint tinge of fawn color on the chest; striping of female below a darker, more blackish brown; wing of males, 162–171, of females, 173–182; in size nearest *peninsularis* Mearns of southern Lower California, which, however, is even paler than *phalæna* of the southwestern United States.

Type.—No. 57811, Dwight Collection; breeding male; Antigua, Guatemala; May 20, 1924; A. W. Anthony.

Material Examined

Cerchneis sparveria sparveria.—Several hundred specimens from most of North America, eastern Mexico and Central America, including type of *C. s. guatemalensis* Swann from Capetillo, Guatemala.

Cerchneis sparveria phalæna.—Over one hundred specimens from the southwestern United States and western Mexico south to Durango.

Cerchneis sparveria tropicalis.—Guatemala: Antigua, 2 ♂ ad., 1 ♂ imm., 2 ♀ ad., 1 ♀ fledgeling.

Also ample series of *paula* and every proposed West Indian form.

Some years ago, in determining Central American migrant sparrow hawks, Miller and I had occasion to examine the entire series of several hundred specimens in The American Museum of Natural History. At that time, we came to the conclusion that *phalæna* was a very poor race, and to prove tenable at all, would have to be restricted to the southwestern United States and northwestern Mexico, where it is almost entirely non-migratory. It averages slightly paler, the wing-coverts perhaps average less spotted, and a higher percentage of individuals would seem to have more extensive crown-patches, although both extremes occur in both races. There is nothing of racial value in size, spotting of males below, or in the shade of color of the chest. Older males tend to be more richly colored and less spotted below in both races. It follows that typical *sparveria* is found in the greater part of North America, and is the only form occurring in winter in Central America.

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[1] For the first paper, see Amer. Mus. Novit., No. 379, 1929.

At about the same time, Swann published a revision of this species in his 'Synopsis of the Accipitres,' making free use of characters of no subspecific value. Among other things, he described *guatemalensis* from Capetillo, remarking that he regarded "the birds with heavily marked underparts, little or no color on the chest, and little or no red in the crown, as quite distinct and forming the resident race in Central America," in spite of the evidence that there was no such thing. His description was an excellent characterization of the immature male eastern sparrow hawk. His collection was acquired by the Museum of Comparative Zoölogy, his type is before me, and it is nothing but an immature male *sparveria*, thus making *guatemalensis* an absolute synonym of *sparveria*. I have not seen the subsequently designated so-called cotype in the British Museum. While it is probably another immature male *sparveria* (? a June straggler), its proper subspecific allocation cannot affect the nomenclature of the case.

To Mr. Anthony goes the credit of really discovering a breeding sparrow hawk in Guatemala, where it would appear to be confined to the arid portion of the Rio Motagua Valley. As might be expected, it is so different from the North American form as to need no further comment.

Morococcyx erythropygus macrourus, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to typical *Morococcyx erythropygus* (Lesson) of the Pacific lowlands of Central America from Oaxaca to northwestern Costa Rica, but as large as the largest individuals of that form, with the tail proportionately very much longer.

TYPE.—No. 58583, Dwight Collection; ♂ ad.; Progreso, Guatemala; Sept. 20, 1924; A. W. Anthony.

RANGE.—Isolated in the arid portion of the Rio Motagua Valley from Progreso to Gualan.

SPECIMENS EXAMINED

Morococcyx e. erythropygus.—Costa Rica: Guanacaste region, 3 ♂, 3 ♀ (M. C. Z.). Nicaragua: various localities in the northwestern Pacific lowlands, 3 ♂, 3 ♀

(A. M. N. H.). Guatemala (Pacific slope): Ocos, 1 ♂; Hacienda California, 1 ♀ (Dwight Coll.). Mexico: Oaxaca, Tehuantepec, 1 ♂, 1 ♀; Tapanatepec, 2 ♂, approaching *mexicanus* (M. C. Z.).

Morococcyx e. macrourus.—Guatemala: Progreso, 1 ♂, 1 ♀ (Dwight Coll.); Gualan, 1 ♂, 2 ♀ (Field Museum).

Lack of properly sexed specimens probably induced Ridgway to regard this cuckoo as a remarkably variable bird, with both sexes alike. As a matter of fact, females are paler, less richly colored below. The northern race, *mexicanus*, is a paler bird especially below, the males being about the same color as females of the typical form. It also averages larger. Specimens from Tehuantepec and Tapanatepec, Oaxaca, are intermediate, nearer *erythropygus* in color, but averaging larger. Three specimens, not listed above, from the arid highlands of north central Nicaragua near Matagalpa, show a distinct approach in size to *macrourus*.

MEASUREMENTS

	Wing	Tail
♂ Pacific lowlands (Guatemala–Costa Rica)	90–99 (93)	121–130 (125)
♂ Northern interior Nicaragua	96–99 (97.5)	121–134 (132.5)
♂ Guatemala interior	96–99 (97.5)	140–141 (140.5)
♀ Pacific lowlands	92–96 (94)	120–126 (123 5)
♀ Northern interior Nicaragua	96	134 (134)
♀ Guatemala interior	92–95	138–140 (139)

Synallaxis erythrothorax pacifica, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to typical *Synallaxis erythrothorax* Sclater of Vera Paz, Guatemala, but paler throughout, the flanks less washed with olive, and almost specifically distinct in that the throat is gray, not black.

TYPE.—No. 56259, Dwight Collection; ♂ ad.; San Felipe, Retalhuleu, Pacific slope of Guatemala; Dec. 11, 1919; Austin Paul Smith.

MATERIAL EXAMINED

Synallaxis erythrothorax erythrothorax.—Vera Paz, Guatemala, 24 specimens (Dwight Collection); about 50 others in the Mus. Comp. Zool., from Guatemala, British Honduras, and Honduras.

Synallaxis erythrothorax pacifica.—Pacific slope of Guatemala, 35 specimens from six localities (Dwight Collection).

This very distinct form is one of the real surprises in Mr. Anthony's collection. The species occurs in a very limited area on the Pacific slope of Central America, and this colony is completely isolated by the Cordilleras from the Caribbean slope race.

Megarhynchus pitangua deserticola, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Megarhynchus pitangua mexicanus* (Lafresnaye) of eastern Mexico to Panama, but upperparts averaging browner, less olive-green; underparts pale lemon yellow, instead of bright lemon, canary, or gamboge.

TYPE.—Dwight Collection; ♂ ad.; Sacapulas, 25 miles east of Nebaj, in the arid Rio Negro Valley, Guatemala; Feb. 6, 1928; A. W. Anthony, original number 6536.

MATERIAL EXAMINED

Megarhynchus pitangua mexicanus.—The type and 56 specimens from the entire range.

Megarhynchus pitangua deserticola.—Sacapulas, Guatemala, 5 ♂, 3 ♀.

The pale-yellow underparts of the new form are strikingly distinct in series. The greatest care has been used to base the diagnosis on comparable material, as the specimens of the new form are all more or less worn, early spring birds. As is usual in tyrant flycatchers, fresh fall birds of this species are greener above and deeper yellow below. This new flycatcher is another of the rapidly lengthening list of birds which are isolated in the desert areas of the two river valleys in central Guatemala.

Pitangus sulphuratus pallidus, new subspecies

SUBSPECIFIC CHARACTERS.—Nearest *Pitangus sulphuratus derbianus* (Kaup) of Texas and northern Mexico, but smaller, grayer brown above, paler rufous edgings to the primaries, and much paler yellow underparts; resembling *P. sulphuratus guatimalensis* (Lafr.) of adjoining tropical areas of Guatemala in size, but coloration differing as in *derbianus*, but in even greater degree as regards the yellow of the underparts.

TYPE.—Dwight Collection; ♂ ad.; Sacapulas, 25 miles east of Nebaj, in the arid Rio Negro Valley, Guatemala; Feb. 26, 1929; A. W. Anthony, original No. 6650.

MATERIAL EXAMINED

Pitangus sulphuratus derbianus.—Texas and northern Mexico, 20.

Pitangus sulphuratus guatimalensis.—Over 50 specimens from Guatemala to western Panama.

Pitangus sulphuratus pallidus.—Guatemala: Sacapulas; the type.

The single specimen is so different from *derbianus* and *guatimalensis*, reflecting in its pale coloration the arid conditions of its restricted environment, that I have no hesitation in describing it as new. Care has been taken to use comparably worn material.

THE GENUS *Polioptila* IN CENTRAL AMERICA

Lack of material has caused this group to remain in great confusion, ever since the interesting critique of Salvin and Godman ('Biol. Cent. Amer.,' I, 1879, pp. 52–55), who gave a masterly résumé of the anomalies in the situation and the impossibility of devising a nomenclature to fit the facts as they knew them. Mr. Ridgway ('Birds N. and Mid. Amer.,' part 3, 1904, pp. 710–731), in his treatment, made minor changes only. His material was no more adequate than that of Salvin and, in discussing the problem, he admitted that five times as many specimens were necessary for an adequate solution.

A brief review of the facts follows.

1. Bonaparte (1850) describes *Polioptila bilineata* (Cartagena, Colombia). Broad white superciliary confluent with white loral region. Later recorded from Santa Marta, western Ecuador, and northwestern Peru.

2. Sclater and Salvin (1860) describe *P. albiloris* from the Motagua Valley, Guatemala. No superciliary, but lores white. Later recorded by them from Oaxaca and western Nicaragua.

3. Lawrence (1861) describes *P. superciliaris* (Lion Hill, Canal Zone). Regarded by Salvin and Godman as a synonym of *P. bilineata*, which (in 1879) they recorded from scattered localities in Central America north to Guatemala, including western Panama, western Costa Rica and Salvador. Ridgway (1904) regards *superciliaris* as a smaller and darker Central American relative of *bilineata*, which he knew definitely only from Santa Marta and Veraguas, western Panama (Pacific slope). He describes *P. superciliaris magna* as a larger and even darker form from the highlands of Costa Rica, later synonymized by Carriker (1910).

4. Baird (1864) describes *P. nigriceps* from Mazatlan, Sinaloa, Mexico. No superciliary; lores black. Recorded by Salvin and Godman from Oaxaca and Salvador. Extra-Mexican records questioned by Ridgway (1904).

5. Lawrence (1885) describes *P. albiventris* from Yucatan. Like *P. nigriceps* but paler, whiter below, smaller, with more white on outer tail-feathers. Ridgway (1904) records a female with a narrow superciliary, and notes males with a faint indication of a superciliary.

6. Ridgway (1903) describes *P. bairdi* from western Nicaragua. No superciliary; lores partly black, a black line from rictus to eye. In 1904 he gives range as western Nicaragua and northwestern Costa Rica, and assumes that all older records of *P. albiloris* from this region belong here. This assumption proves to be incorrect. He points out that *P. bairdi* is smaller than *P. albiloris*, *nigriceps* and *albiventris*, with an even shorter tail.

It will thus be seen that six "species" are involved with relatively minute differences between any two of them, but of a character which enables any specimen to be named at a glance, excepting *superciliaris* as compared with *bilineata*.

We will now turn to the large series available in The American Museum of Natural History, supplemented by the Dwight Collection and the collections of the Museum of Comparative Zoölogy, and examine the local variations in detail.

1. *Polioptila bilineata*, 59 specimens from Santa Marta (4), western Ecuador, western Peru, and eastern Panama. It is quite impossible to distinguish two races

in spite of geographic isolation, both series showing dark and light, larger and smaller specimens.

2. *P. superciliaris* Lawrence. The name is currently applied to the type and all specimens with white superciliaries, northward.

MATERIAL EXAMINED

Caribbean slope of Central America.—Western Panama and Canal Zone: the type and 12; eastern Costa Rica, 12; eastern Nicaragua, 5; eastern Guatemala, 12; British Honduras, 1; Quintana Roo, 1. Pacific slope.—Veraguas, 2; Chiriqui, 1; southwest Costa Rica, 34; northwest Costa Rica, 23. Total 104.

This great series makes it impossible to separate Central American from South American material either by color or size. At one time I thought that it might be possible to regard *superciliaris* as a slightly darker and smaller subspecies restricted to the Caribbean slope of Central America, regarding Pacific coast birds as *bilineata*, but additional material examined in the last five years makes this disposition of the case untenable. It so happens that 3 males from the Canal Zone are particularly small. Birds from eastern Costa Rica and Guatemala are larger, like western Ecuador series: eastern Nicaragua birds are smaller, resembling southwestern Costa Rican series, while northwestern Costa Rican specimens average larger. Ridgway's comparative measurements were based on only 3 males of *bilineata*, one of which came from Veraguas. The type of *superciliaris* is a particularly gray bird below, but grayer and whiter birds occur in all the series listed above. The specimens from eastern Guatemala average minutely darker than any other series, but not sufficiently so for separation. It is conceivable, of course, that a series of 30–40 from Santa Marta might show a slightly paler local race, reflecting a drier environment, but until such evidence is produced, *superciliaris* is an absolute synonym of *bilineata*.

3 *P. bairdi* Ridgway. I have examined 8 from northwest Costa Rica and 15 from western Nicaragua, the supposed range of this form. In Costa Rica, 1 only is *bairdi* as to characters, 1 is *albiloris*, 2 are *albiloris* with traces of a superciliary, and 4 are *nigriceps*. In west Nicaraguan males, 2 are *bairdi* as to characters, 1 is *albiloris*, and the balance *nigriceps*.

4. Twenty-one specimens from western Mexico show a similar state of affairs. Of 5 males from Tehuantepec, 1 is *albiloris* with traces of a superciliary, 1 is *albiloris*, 2 are *bairdi*, and 1 is *nigriceps*. Four males from Chivela, Oaxaca, are *nigriceps* with a white feather or two in the loral region, and 1 male from southern Sinaloa is similar. All others are *nigriceps*.

5. *P. albiloris*. A series of 17 from Progreso, in the Rio Motagua Valley, central Guatemala, are topotypes. Only ONE of these birds is *albiloris* as to characters, 2 have white feathers on ONE SIDE ONLY, and all others are *nigriceps*.

6. Yucatan specimens, including the type, are constantly different from all other Mexican and Central American series in being slightly paler above and nearly pure white below. The majority are *nigriceps* as to head characters, but some show traces of white in the lores or superciliaries.

There would seem to be only one reasonable conclusion to draw from this series of facts. All the supposed "species" boil down to one—*bilineata*. This bird was of South American origin and pushed northward into Central America. The character of the white superciliary tends to break down, wherever it encounters a dry or arid climate, and disappears almost completely in western and northwestern Mexico. In northwestern Costa Rica the great majority of individuals have white lores and superciliaries. At the northern limit, the great majority of individuals are all black. In an intermediate area (Nicaragua to Oaxaca) intermediate birds variously black and white appear sporadically, but never constantly in any one region. The Central American Polioptilæ are as follows:

1. *Polioptila bilineata bilineata* (Bonaparte). West Ecuador and Colombia north to Guatemala and Quintana Roo (Caribbean slope) and northwestern Costa Rica (Pacific). Lores and superciliaries wholly white. Includes *P. superciliaris* and *P. superciliaris magna.*

2. *Polioptila bilineata albiloris* Sclater and Salvin. Pacific slope of Central America from northwest Costa Rica to Sonora and the arid interior of Guatemala (Rio Motagua Valley from Progreso to Gualan). Lores and superciliary wholly black, or mixed with white, the number of individuals showing white increasing proportionately southward. Includes *P. nigriceps*, *P. nigriceps restricta* Brewster and *P. bairdi*. It is most unfortunate that the inappropriate name *albiloris* has priority over the appropriate *nigriceps*, especially as topotypes are chiefly "*nigriceps*" as to characters. Measurement of additional Mexican material shows that southern specimens do not have shorter tails in proportions sufficient for subspecific separation.

3. *Polioptila bilineata albiventris* Lawrence. Outer third of Yucatan Peninsula. Paler; superciliary variable, but chiefly black.

Heleodytes capistratus xerophilus, new subspecies

Subspecific Characters.—Connecting the species *capistratus* Lesson with *rufinucha* Lafresnaye of Vera Cruz; differing radically from *capistratus* in having the upperparts conspicuously variegated with black and white in a herring-bone pattern with central shaft streaks narrower, the tail mostly black as in *capistratus*, the nuchal collar twice as broad, and the underparts with at most a few spots only on the flanks. Closest to *H. capistratus nicaraguæ* Miller and Griscom of the arid interior of northern Nicaragua, but upperparts much less variegated with a black and white "herring-bone" pattern.

Type.—No. 58781, Dwight Coll.; Progreso, Guatemala; Oct. 30, 1924; A. W. Anthony.

Material Examined

Heleodytes capistratus capistratus.—Large series from Nicaragua and northwestern Costa Rica.

Heleodytes capistratus nigricaudatus.—Large series from Pacific coast of Guatemala.

Heleodytes capistratus xerophilus.—Large series from Progreso in the arid interior of Guatemala.

Heleodytes capistratus nicaraguæ.—Nine specimens from northern central Nicaragua.

Heleodytes capistratus rufinucha.—The type and 5 others from Vera Cruz.

Heleodytes capistratus humilis.—Large series from Oaxaca.

Heleodytes capistratus castaneus.—Several from eastern Honduras.

When Miller and I described *Heleodytes rufinucha nicaraguæ* (Amer. Mus. Novit., No. 159, 1925, p. 8) we did not have topotypes of *rufinucha*, and were forced to assume that a small series from Progreso, Guatemala, represented this "species." Since then the material of most of the forms involved has more than doubled. Direct comparison of 30 specimens from Progreso with the type and others from Vera Cruz shows the existence of a very distinct form connecting the two supposed species. The Guatemalan material of *nigricaudatus* shows that it is partially connected with *xerophilus* by individual variation. Occasional specimens have a little concealed barring on the back, others have slightly spotted under tail-coverts. A single bird from Lake Amatitlan, a geographically intermediate locality, has as heavily spotted under tail-coverts as any specimen of *xerophilus*, and is a genuine intergrade. Intermediates between *capistratus* of the Pacific coast of Nicaragua and *nicaraguæ* of the interior were collected at Tipitapa.

As is well known, these cactus wrens become terrifically worn. Wear has interesting results in the appearance of *xerophilus*. Fresh specimens have the barring of the basal two-thirds of the back feathers partly concealed by the uniform reddish tips. Such specimens appear to be closest to *capistratus*. Very worn breeding birds completely lose these reddish tips, and consequently appear more closely related to *rufinucha*.

In this whole group, "speciation" has been greatly overdone. Farther north in Mexico, *gularis*, *jocosus*, and *narinosus* are obviously representative forms. *H. megalopterus* and *H. nelsoni* are certainly conspecific, and it is doubtful if they are specifically separable from the *zonatus* group.

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NEW DIPTERA FROM NORTH AND CENTRAL AMERICA

By C. H. Curran

The following pages contain descriptions of new flies from North and Central America. The types of the new species are in The American Museum of Natural History.

BOMBYLIIDÆ

In the genus, *Exoprosopa* Macquart is a species group characterized by having the anterior margin of the wing brown and without hyaline indentations. In this group the base of the wing is brown and beyond this the brown pattern variable in width but almost always reaching to beyond the end of the subcostal vein, decreasing in width apically. This group has received very little attention from students of the family and identifications have always been of a tentative nature. The species first described have evidently not been found in numbers since the descriptions appeared, but several related froms have been identified under the existing names, two or more species often appearing above a single label.

During 1916 and 1920, Dr. F. E. Lutz collected a large number of specimens of *Exoprosopa* in Texas, Arizona, and Colorado, many of them falling into the group which I have designated as II for convenience. These form the basis of the present paper, but in order to correct some erroneous synonymy and to simplify the identification of species in the genus I have prepared keys to each of the groups. Of Group I we have no specimens; of Group II most of the species are represented and only the species related to *fasciata* are omitted from the key; in Group III only the species in the collection are included, the recently described forms being very difficult to identify and from the descriptions it is impossible to place them in a key.

In Group II the first seven specimens appearing in the key actually belong to a genus other than *Exoprosopa,* being characterized by a long, projecting proboscis and the presence of spicules or small bristles on the anterior tibiæ; the remaining species including Groups I and III belong together, unless the petiolate first posterior cell should be considered of generic value. However, the American Bombyliidæ are so badly in need of a thorough generic and specific revision that it seems wisest at the present time to leave the species under the one generic name, hence no attempt is made here to segregate the species into the genera recognized in the Old World.

Key to Groups of *Exoprosopa*

1. Wings with fasciate markings.................Group III.

Wings hyaline or brown in front, the cross-veins sometimes clouded........2.

2. Wings brown in front or almost evenly pale brownish............Group II.

Wings hyaline.................Group I.

Group I

1. First posterior cell closed and long petiolate...............*tiburonensis* Cole.

First posterior cell open.................2.

2. Style not longer than the width of the segment...........*hyalipennis* Cole.

Style two-thirds as long as third antennal segment..............*atripes* Cole.

Group II

1. First posterior cell open.................2.

First posterior cell long petiolate at the apex.................21.

2. Proboscis projecting beyond the oral opening for a distance much greater than the length of the labellæ.................3.

At most the labellæ projecting beyond the oral margin.................9.

3. Antennal style as long as or longer than the third antennal segment.......6.

Antennal style not over three-fourths as long as the third antennal segment..4.

4. The proboscis projects distinctly less than the length of the head beyond the oral margin, the suture at base of labellæ before the middle of the projecting section.................5.

The proboscis projects more than the length of the head beyond the oral margin, the suture well beyond the middle of the projecting section..*clarki*, n. sp.

5. No trace of brown cloud at base of third posterior cell....*dodrans* Osten Sacken.

A faint cloud at base of third posterior cell.............*filia* Osten Sacken.

6. Style twice as long as third antennal segment...........*socia* Osten Sacken.

Style not nearly twice as long as third segment.................7.

7. A distinct brown cloud at base of fourth posterior cell.................8.

Scarcely a trace of brown cloud at base of fourth posterior cell...*lutzi*, n. sp.

8. Face reddish in ground color at least on the lower half........*dodrina*, n. sp.

Face blackish except the narrow oral margin............*rostrifera* Jænnicke.

9. Either the vein at the base of the second posterior cell or the cross-vein separating the second and third submarginal cell clouded with brown.............10.

Both these veins unclouded or all the veins clouded.................13.

10. Second basal cell hyaline or tinged with brown, its base a little brownish....11.

Second basal cell brown not contrasting with the brown area..*pavida* Williston.

11. Second basal cell distinctly tinged with brown..............*agassizii* Loew.

Second basal cell almost hyaline.................12.

12. Intermediate abdominal segments with broad yellow or white cross-bands on basal half (*brevistylatus* Williston).................*pardus* Osten Sacken.

Intermediate segments black basally, paler apically. .....*sackeni* Williston.
13. All the veins clouded with brownish or luteous. . .*fasciata* Macquart.
Longitudinal veins not wholly clouded........ .... 14.
14. Second basal cell almost wholly brown... .... .18.
Second basal cell almost wholly sub-hyaline. ... . .15.
15. Antennal style much longer than width of third antennal segment . .. 16.
Antennal style not longer than width of third antennal segment .*texana*, n. sp.
16. Vein at base of fourth posterior cell distinctly clouded...... .. .. .17.
Vein at base of fourth posterior cell not at all clouded.. ....*bifurca* Loew.
17. Mesonotum with coarse yellow hair in front of the scutellum.
titubans Osten Sacken.
Mesonotum with coarse black hair in front of the scutellum... *mus*, n. sp.
18. Face black in ground color..... ....19.
Face reddish in ground color.. .. ..20.
19. A large area of silvery white scales between and above the antennæ.
albifrons, n. sp.
Black and yellow scales in this region.. .... *panamensis*, n. sp.
20. Face and front destitute of black scales. ... ...*junta*, n. sp.
Face and front with black scales in the middle . ...*brevirostris* Williston.
21. Wings hyaline, the costal and subcostal cells yellowish.......*tiburonensis* Cole.
Wings brownish, paler posteriorly...................*limbipennis* Macquart.

GROUP III

1. Anal cell crossed by a hyaline band on basal half..... . . . . .4.
Anal cell brown on basal half......... .... 2.
2. Dilated portion of marginal cell wholly brown. ... .*decora* Loew.
Dilated portion of marginal cell partly or wholly hyaline.... ....3.
3. Marginal cell wholly hyaline apically..... ....*emarginata* Macquart.
Marginal cell brown at the apex.... ....*lacera* Wiedemann.
4. Apical part of marginal cell wholly hyaline... . ... 8.
Apical part of marginal cell partly or wholly brown.... .... .5.
5. The long hair on the upper part of the pleura is wholly yellow or whitish....6.
The long hair is largely black..... ....7.
6. The hyaline spot in the marginal cell lies well before the bulbous part.
calyptera Say.
The hyaline spot is partly or wholly in the bulbous part. .*philadelphica* Macquart.
7. No hyaline spot in the marginal cell..................*capucina* Fabricius.
A hyaline spot in the marginal cell....... ....*fascipennis* Say.
8. Antennal style longer than width of third antennal segment.. ....10.
Antennal style shorter than width of third antennal segment................9.
9. The apical brown cross-band extends into the third posterior cell.
eremita Osten Sacken.
The apical brown cross-band does not cross the second posterior cell.
sima Osten Sacken.
10. Veins at base of third posterior cell broadly brown......... ....11.
No brown surrounding these veins................ ...*grata* Coquillett.
11. The brown spot at the base of the third posterior cell is at most obscurely connected with the apical fascia.......................................12.

The brown spot is connected with the fascia in almost its full width.
pueblensis Jænnicke.

12. Pleura with only white or yellow pile above.................13.
Pleura largely black-haired above..........*iota* Osten Sacken.
13. Legs black, the anterior tibiæ rarely red............*pueblensis* Jænnicke.
Femora and basal half or more of the tibiæ, reddish......*doris* Osten Sacken.

Exoprosopa clarki, new species

Related to *filia* Osten Sacken but with longer proboscis and a deep brown cloud at the base of the fourth posterior cell. Length, 14.5 mm.

Male.—Face, cheeks, and lower three-fifths of the front yellowish red in ground color, the scales golden yellow, less abundant on the upper half of the front, a few scattered black ones on the lower half of the front. Hair on face and front black, on the cheeks yellow, the occiput behind with short, erect white hair, along the orbits with dense, fine white scales. Antennæ black, the basal segment reddish; third segment elongate conical, the style three-fifths as long as the segment. Proboscis projecting more than the length of the head beyond the oral margin.

Thorax black, the pleura gray pollinose; posterior calli and scutellum brownish red. Pleura and anterior fourth of the mesonotum with long, bright yellow pile; sides of the mesonotum behind the notopleura and the upper, posterior part of the mesopleura white-haired. Mesonotum with scale-like shining black tomentum; along the dorso-central lines with a stripe of yellow tomentum, the posterior border broadly yellow-haired. Scutellum with black scales on basal half and yellow apically, the hair black on the disc, yellow on the sides and apical border; about twelve black marginal bristles.

Legs reddish; tarsi black; anterior four femora and tibiæ with black scales in front; the posterior ones with only a few black scales; anterior tibiæ with spicules.

Wings cinereous hyaline, brown in front of the fourth vein to beyond the anterior cross-vein, thence obliquely to the costa beyond the end of the first vein; the base of the wings broadly on their full width, a large cloud surrounding the vein at the base of the fourth posterior cell, and a much smaller cloud at the base of the third posterior cell also brown; a pale yellow-brown infuscation covers the basal half of the second basal cell and the basal fifth of the anal cell. Squamæ reddish yellow with somewhat paler fringe. Halteres reddish yellow.

Abdomen black, the sides broadly, apices of the segments and broad apex of the abdomen reddish, the venter wholly reddish. Scale-like tomentum black, the second and fourth segments each with a very broad white anterior fascia, the seventh wholly white. Second segment with a narrow orange fascia anteriorly which widens toward the lateral margins, sixth orange on the apical half with only scattered black scales in the middle, the fifth with the apical half orange on the lateral fourth. Base of the abdomen broadly.the broad base of each segment except medianly, and the whole of the seventh segment with yellow or tawny hair, the hair on the dorsum, however, appearing mostly black, the lateral margins with dense hair which is yellowish on the first three segments and more tawny on the narrow bases of the following three, the posterior half or more of the third to fifth segments with black hair. The venter bears tawny hair and scales, the latter with paler ones intermixed.

Holotype.—Male, Mud Springs, Santa Catalina Mts., Arizona, about 6500 ft., August 19, 1916, (F. E. Lutz).

Named in honor of Mr. B. Preston Clark, under whose auspices the expedition to Arizona was undertaken.

Exoprosopa lutzi, new species

Related to *rostrifera* Jænnicke but with no trace of a brown cloud at the base of the fourth posterior cell. Length 14 mm.

MALE.—Head black, the oral border reddish or reddish yellow, the whole thinly gray pollinose and appearing slate-colored; lower half of the front, the sides above, and the face wholly, with yellow scales. Pile pale yellow, black on the front and middle of the face. Front of moderate width, the sides but little converging on the upper half. Occiput with white, scale-like tomentum; ocellar triangle reddish. Basal two antennal segments reddish, the third conical, the style about one-third longer than the third segment. Proboscis projecting more than half its length beyond the oral margin.

Pile of thorax reddish yellow; paler yellow on the sides above the wings, the hair of the dorsum black, the prescutellar area with some long, hair-like tomentum. Mesonotum clothed with black, scale-like tomentum which is divided by three broad, pale vittæ, the median one not strongly marked. Scutellum brownish red, with the broad base and sides black; tomentum mostly black, pale on the border, the hair black and sparse; five or six black bristles on either side.

Legs reddish, with numerous black scales; apices of the tarsal segments, apical segment of the anterior four, and apical four of the anterior pair, black or brown; anterior tibiæ with spicules.

The brown wing-pattern extends from about the basal third of the second basal cell to the apex of the first vein and also covers the basal sixth of the anal cell. Squamæ rusty yellow, the fringe yellow. Halteres reddish, the basal half of the knob brownish.

Abdomen black, the sides broadly reddish; apices of segments reddish; with black, scale-like tomentum, the apices of the segments with yellow scales; second segment with a broad band of white, the seventh wholly white; the abdomen is a little rubbed and there may be much more extensive yellow scaling toward the sides. Sides of abdomen denuded except at the base where the pile is pale yellow; all the dorsal hairs are black except on the basal segments. Venter reddish, with yellowish hair, the scale-like tomentum mostly black.

HOLOTYPE.—Male, Sycamore Canyon, Santa Catalina Mts., Arizona, August 20, 1916, (F. E. Lutz).

Exoprosopa dodrina, new species

Related to *rostrifera* Jænnicke but with a small brown spot at the base of the third posterior cell, the face mostly reddish, the postocular tomentum whitish, etc. Length, 12 to 14 mm.

MALE.—Head black; face and cheeks reddish, the former usually with a large blackish spot in the middle, the reddish color sometimes covering the lowest fifth of the front. Pollen of the front brown, of the occiput gray. Lower half of front and the face densely golden-yellow scaled, the scales extending along the sides of the front almost to the ocelli; hair of front and middle of face black, on the sides of the face golden yellow; occiput with whitish pile and with whitish tomentum along the orbits.

Basal two antennal segments reddish; third black, rather short conical, the style about one-half longer than the third segment. Proboscis projecting a little more than half its length beyond the oral margin.

Thorax black; pleura gray pollinose; mesonotum rather brownish tinged, black tomentose, with three pale tomentose vittæ, the median one broad. Pile reddish yellow or pale tawny, pale yellow above the wings, the erect dorsal hairs black. Scutellum brownish red, the base black; hair black; tomentum black, the broad border with golden-yellow tomentum; about ten marginal bristles.

Legs reddish; apical tarsal segment and sometimes most of the front tarsi, brown or black; femora usually with some scattered black scales. Anterior tibiæ with spicules.

The brown color fills the basal third of the anal cell and extends obliquely to a little beyond the apex of the first vein; base of third posterior cell with small, of fourth posterior with large brown cloud. Squamæ reddish yellow, with paler fringe. Halteres brownish red, with yellow apex to the knob.

Abdomen black, the sides of the second and third segments and the apices of the segments reddish; second and fourth segments with broad white bands, the seventh wholly white, the third basally white on the sides except posteriorly; very broad apices of each segment, (apical third or more) tawny, the space in front black tomentose. Lateral pile reddish yellow, the apices of the segments with black hairs sometimes predominating, the dorsal hair black except on base of abdomen and the seventh segment. Venter pale orange, the pile of the same color, the tomentum white, yellow on the fifth and sixth segments.

FEMALE.—Similar to the male but with a wider front.

TYPES.—Three males and four females, Boulder, Colorado, about 5500 ft., August 7–12, 1919, (F. E. Lutz), and one female, southern Arizona, August, 1902, (F. H. Snow). The holotype, male, and allotype, female, are from Boulder.

Exoprosopa pardus Osten Sacken

OSTEN SACKEN, 1886, 'Biol.-Centr. Amer.,' Dipt. I, p. 88 (f.).

?*Exoprosopa brevistylata* WILLISTON, 1901, 'Biol.-Centr. Amer.,' Dipt., I, p. 272.

A single male, Sabino Basin, Santa Catalina Mts., Arizona, (F. E. Lutz).

This specimen agrees with both the descriptions given above and it seems likely that both names apply to the same species. I have seen no specimens agreeing with the descriptions from Mexico and it is possible that my identification is wrong. The types of *pardus* and *brevistylata* are in the British Museum and the question of their relationship can be easily settled.

Exoprosopa texana, new species

Related to *titubans* Osten Sacken but the antennal style is hardly as long as the width of the third antennal segment. Length, about 14 mm.

MALE.—Head black, the cheeks and oral border yellow; front and face with yellowish scales; hair of front black, of the face pale yellow; occipital pile whitish;

postocular tomentum white. A patch of black hair at the anterior oral margin. Antennæ wholly black; third segment elongate conical; style very short, not as long as width of third antennal segment. Proboscis scarcely projecting beyond the oral margin.

Thorax black; pleura gray pollinose; the pile pale yellow, reddish yellow above on the anterior half of the mesonotum, whitish above the wings. Mesonotum with black tomentum and three entire, broad yellow tomentose vittæ, the median one widest and increasing in width posteriorly. Scutellum brownish red, the base broadly black; tomentum yellow, only the median third at the base black-scaled; hair black except at the sides; about fourteen black marginal bristles.

Legs black; anterior tibiæ without spicules.

Wings cinereous hyaline, brown in front of the fourth vein to a little beyond the anterior cross-vein, thence in front of the second vein to beyond the middle of the basal submarginal cell, the base of the wing brown. A cloud at the base of the fourth posterior cell and sometimes a faint small one at the base of the third posterior. Squamæ pale yellow, with yellow border and fringe. Halteres reddish, with yellow knob

Abdomen black, the sides of the second to fourth segments reddish. Scale-like tomentum mostly pale, the apices of the segments black-scaled, the dark bands widest on the anterior segments; second, fourth, sixth, and seventh segments white, the white bordered with dull orange posteriorly, the third and fifth dull orange or ochreous. Sides of the abdomen with white hair, the segments with coarse black hair predominating posteriorly; seventh segment yellow-haired. Venter reddish except basally; white tomentose and yellow-haired, the fifth segment dull ochreous with some black scales medianly.

TYPES.—Holotype, male, and two male paratypes, Marathon, Texas, July 1–2, 1916, (F. E. Lutz).

Paratype in Philadelphia Academy of Natural Sciences.

Exoprosopa mus, new species

Related to *titubans* Osten Sacken but the erect hairs in front of the scutellum are black and the apical fringes of all but the last abdominal segment are black. Length, 13 to 14 mm.

MALE.—Head black, the cheeks and oral margin yellow; tomentum of front and face pale brassy yellow; pile of front black, of face yellow, a tuft of black hair at the anterior oral margin. Occiput with whitish tomentum and pile. Antennæ black; third segment conical; style about as long as the third segment. Proboscis projecting the length of the labellæ beyond the oral margin.

Thorax black, pleura gray pollinose, white pilose; mesopleura, sides of mesonotum in front and the collar reddish yellow, bordered behind with white which continues along the lateral margins above the wings. Mesonotum reddish brown tomentose, broadly white in front of the scutellum, the erect hairs black. Scutellum rusty reddish, reddish brown tomentose, the border white, a few black scales at the base in the middle; hair black; eight or ten marginal bristles.

Wings cinereous hyaline; costal and sub-costal cells and first basal cell brown, only a trace of a cloud at the base of the fourth posterior cell. Squamæ brownish yellow, with bright reddish-yellow fringe. Halteres brownish red or brownish with paler knob.

Abdomen black, the sides of the second to fourth segments reddish. Tomentum whitish, the second to sixth segments with black posterior borders, those on the second and third preceded by a narrow reddish-yellow band; seventh segment somewhat silvery. Pile on base and sides of abdomen yellow, the second to sixth segments with coarse black hairs at the apices. Venter reddish with black base, very densely white tomentose and pilose; in one specimen the ground color black.

TYPES.—Holotype, male, Dos Arroyos, Guerrero, Mexico, 1000 ft., (H. H. Smith); paratypes, male, same data as holotype and male, Tierra Colorada, Guerrero, 2000 ft., (H. H. Smith).

The specimen from Tierra Colorada has the venter black and the brown of the wings is deeper in color but I can see no other differences. The dorsum is largely denuded but what remains of the vestiture agrees with the other two specimens.

Exoprosopa albifrons, new species

Related to *brevirostris* Williston but the face is black and there is a large patch of silvery scales on the lower part of the front. Length, 13.5 to 14 mm.

MALE.—Head black; cheeks and oral margin yellowish. Lower half of front and middle of face with broad silvery-white scales. Front narrow above, black pilose; face with yellowish pile; occipital pile yellowish. The occiput has been wet so that it is not possible to determine the color of the tomentum; what remains appears black but it was, no doubt, originally white. Antennæ black, the first segment reddish below; third segment conical; style a little more than half as long as the third segment. Proboscis not projecting beyond the oral margin.

Thorax black, the pleura grayish pollinose; posterior calli and scutellum brownish red. Pile on front of mesonotum and mesopleura, yellow; whitish on the pleura and above the wings. Mesonotum with black tomentum and with three yellowish tomentose vittæ; black hairs rather numerous on anterior half. Base of scutellum black; tomentum mostly reddish yellow; hair black; about fourteen marginal bristles.

Legs black; femora sometimes reddish in ground color; anterior tibiæ without spicules.

Wings brown in front and basally; second basal cell wholly brown, the dark color extending obliquely from the apex of the anal cell to the apex of the first vein; apical two-thirds of anal cell hyaline. Squamæ, fringe, and halteres reddish yellow.

Abdomen black, the sides of the second and third segments reddish; clothed with black tomentum which is normally overlaid on the second, fourth and seventh segments with tomentose white scales, the apices of the second and fourth segments very broadly black. It is possible that there are bands of yellowish scales on the third and sixth segments since there are scattered scales of this color, although the sixth segment may normally be mostly white-scaled. Hair on base and sides of abdomen pale yellow. Venter black, the apices of the segments reddish yellow; tomentum whitish; pile yellow.

TYPES.—Holotype, male, and two paratypes, Mud Springs, Santa Catalina Mts., Arizona, alt. about 6500 ft., (F. E. Lutz).

Exoprosopa panamensis, new species

Abdomen with six broad pale fasciæ, the anterior four usually rather reddish ochreous, the posterior two white and almost always interrupted. Length, 12.5 to 15 mm.

MALE.—Head black; cheeks brownish. Face and front with intermixed black and golden-yellow tomentum, the pale scales usually predominating; hair black. Occipital pile black, the tomentum pale brassy yellow. Antennæ black, the first segment usually obscure reddish; third segment elongate conical, the style about three-fifths as long as the segment. Proboscis projecting beyond the oral margin for less than the length of the labellæ

Thorax black; pile on upper part of pleura, sides and front of mesonotum bright tawny; lower part of pleura black-haired. Mesonotum blackish tomentose, with a very large tawny tomentose triangle on the posterior border which reaches obscurely to the front margin, the short, erect black hair fairly abundant. Scutellum reddish brown in ground color, black tomentose, the free border broadly tawny tomentose; hair black; twelve or fourteen marginal bristles.

Legs black; anterior tibiæ without spicules.

Wings with the base and anterior border deep brown; second basal cell wholly brown, the brown color extending obliquely from a little before the apex of the second basal cell to a point a little before the apex of the first vein; about the basal third of the anal cell brown. Squamæ brownish orange, with reddish yellow fringe. Halteres brownish red with reddish yellow knob.

The abdominal segments are black-scaled behind the pale fasciæ and the abdomen bears tawny pile on the sides of the basal three segments. The pale fascia on the second segment is very wide and normally the fasciæ are narrowed toward the middle, although that on the fourth segment usually retains its full width. While the fasciæ on the sixth and seventh segments are usually white, that on the sixth is frequently tinged with ochreous and the same may be true of that on the seventh segment. Venter black, with some pale scales and reddish-yellow hair on the basal three or four sternites.

FEMALE.—Differs only sexually.

TYPES.—Holotype, male, and allotype, female, Fort Randolph, Canal Zone, January 23, 1929, (Curran). Paratypes.—Forty-three specimens of both sexes from Canal Zone: Fort Randolph, January 23, 1929, February 6, 1929; France Field, January 18, 1929; Corozal, January 31, and February 4, 1929; and Patilla Point, January 15, 1929, (Curran).

This species was very common on the Atlantic side of the Isthmus where it occurred along with a species of *Hyperalonia*.

Exoprosopa junta, new species

Related to *brevirostris* Williston but lacking black scales on the face and front and with brown instead of black tomentum on the mesonotum. Length, 14 mm.

FEMALE.—Face and lower half of front reddish; cheeks yellow; front and middle of face black-haired, the sides of the face with yellow hair. Hair and tomentum of the occiput white. Scales of front and face brassy yellow. Antennæ brown, the first segment reddish; third segment elongate conical, the style three-fifths as long as the segment. Proboscis not projecting beyond the oral opening.

Thorax black; pleura in part, posterior calli and scutellum reddish. Pile on front of thorax and mesopleura reddish yellow; on the pleura and above the wings yellowish white. Tomentum of the mesonotum mostly yellowish, but there are apparently two or three rows of brownish scales; hair black except in front of the scutellum.

Legs reddish, black tomentose behind; anterior tibiæ becoming black apically, their tarsi and the apical four segments of the remaining tarsi black; anterior tibiæ without spicules.

The brown of the wings fills out the second basal cell and extends obliquely to a point opposite the end of the sub-costal vein; only about the basal fourth of the anal cell brown. Squamæ and fringe yellowish red. Halteres reddish with pale knob.

Abdomen black, the sides broadly reddish; evidently clothed with yellowish scales, the apices of the second to fourth segments black-scaled except laterally, all the segments with reddish apices. Pile on the sides and base of the abdomen yellowish; there appear to be some scale-like black hairs at the apices of the intermediate segments. The abdomen is too much denuded to be certain of the arrangement of the vestiture, but it is certain that the scales do not lie above black tomentum. Venter reddish with whitish tomentum and yellow hair, the apical three sternites with transverse, black basal triangles.

HOLOTYPE.—Female, La Junta, Colorado, about 4100 ft., August 12, 1920, (F. E. Lutz).

The wing pattern in this species and *brevirostris* Williston is very similar and is fuller than in allied species. However, the two are very different. The hair on the scutellum of *brevirostris* is long and erect while in *junta* it is short and appressed; *brevirostris* has black scales basally on the terminal abdominal segments, while these are quite absent in *junta*.

ASILIDÆ

Cophura pollinosa, new species

In Melander's key (Psyche, XXX, p. 208, 1923), traces to couplet four where it disagrees with both alternatives. The abdomen is pollinose with the exception of the apex which is shining black, a character not found in any other described species. Length, 9 to 10 mm.

MALE.—Head white pollinose, the front tinged with yellow; hair and bristles white; fine scattered hairs on the sides of the face; palpi and antennæ brown, the latter thinly cinereous pollinose; style as long as second antennal segment.

Thorax gray pollinose; mesonotum with a broad, geminate, posteriorly abbreviated median vitta and two spots on either side brown or blackish brown; bristles white, those on the notopleura brown; no pile except on the prothorax; scutellum with a bristle and a bristly hair on either side.

Legs shining black, the coxæ pale pollinose; hair and bristles white; anterior tibiæ on basal half, middle pair on basal two-thirds, and posterior pair on basal three-fourths, reddish yellow. Middle tibiæ with the usual two short, obtuse black spines at apex of the ventral surface.

Wings cinereous hyaline or with a brownish-yellow tinge; anal cell open. Squamæ with short white fringe. Halteres yellow.

Abdomen with almost parallel sides on basal three-fifths, tapering apically; covered dorsally with brown pollen which is thinner on the apical segment and genitalia, the sides broadly and the broad apices of the segments grayish pollinose; venter with gray pollen. Pile short and black dorsally, white on the sides and venter.

FEMALE.—Seventh segment and genitalia polished black, the sixth segment often largely polished black dorsally.

TYPES.—Holotype, male, Kits Peak Rincon, Baboquivari Mts., Arizona, August 1–4, 1916, alt. about 4050 ft.; allotype, female, Coyote Mts., Arizona, August 4–7, 1916, alt. about 3500 ft.; paratypes, two males and four females, same localities, August 1 to 10, 1916.

Paratypes in the Philadelphia Academy of Sciences.

CEROTAINIOPS, new genus

In many respects intermediate between *Cerotainia* Schiner and *Atomosia* Macquart but at once distinguished from both genera by the shape of the third antennal segment which is rather short, narrowly pyriform and obtusely rounded apically. The abdomen is robust and almost bare as in *Atomosia* and the wing venation is similar. In Hermann's key to the genera of the Atomosinæ (Nova Acta, XCVI, pp. 28–33, 1912) the genotype traces to the following genera, depending upon the category in which it is placed according to shape of head: (1) if the head is considered to be more than twice as wide as high traces to *Amathomyia* Hermann but the shape of the antennæ and presence of five posterior cells at once distinguish it from this genus; (2) if the head is considered as not more than twice as wide as high, traces to *Cenochromyia* Hermann, but the shape of the antennæ at once throws it out of this genus. In Williston's 'Manual,' 1908, traces to couplet 6 of the Laphrinæ, where it differs from *Cerotainia* in having the first antennal segment but little longer than the second and from *Atomosia* by the short third segment and the widening of the front toward the vertex. The genus further differs from both of these by having the lateral slopes of the metanotum bare. The marginal cell is long petiolate

GENOTYPE.—*Cerotainiops rufiventris*, new species.

Cerotainiops rufiventris, new species

Figure 1

Brown in ground color, the abdomen brownish red; wings with brownish yellow cloud on apical half. Length, 13 to 14 mm.

FEMALE.—Head densely whitish pollinose, the hair and bristles wholly white; face slightly convex, a little more produced at the oral margin than at the base of the antennæ, about as long as wide, wholly covered with fairly long, sub-appressed hair; the bristles of the mystax are rather fine, either yellow or black, and limited to a double row close to the oral margin. Mouthparts shining black. Antennæ brown, the basal segments with more or less reddish tinge at the ends, the apical two segments thinly pollinose.

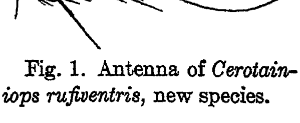

Fig. 1. Antenna of *Cerotainiops rufiventris*, new species.

Pleura, except a large spot in front of the middle coxæ and a small spot above the posterior coxæ, yellowish-white pollinose, the broad sides and posterior border of the mesonotum and the scutellum, except its free border, with similar pollen; a narrow line of pale pollen extends inward along the suture and is connected at its inner end by a slender longitudinal vitta with a wider band extending inward from behind the humeri; the humeri have a large bare spot on their outer edge. The thorax lacks bristles except on the sides and bears short, sparse whitish pile which is very fine on the pleura and appressed; on the mesonotum it is coarser and a little longer in addition to being appressed. The scutellum bears at the apex a border of short, erect hairs which extend but little above its upper surface; the disc bears short, erect hairs.

Legs castaneous or black; if castaneous, the femora largely and the tarsi somewhat darker; if black, the tibiæ paler on the broad bases; coxæ whitish pollinose. Bristles and hair of legs white.

Wings cinereous hyaline with brownish-yellow cloud on the apical half, the apical third grayish anteriorly, the posterior border with faint whitish tinge in some lights. Squamæ yellowish with very short fringe. Halteres reddish yellow.

Abdomen brownish red, convex, very slightly increasing in width from the base to the base of the sixth segment; pile short, sparse, appressed, whitish, on the sides and apex more abundant and in some views appearing whitish with yellow tinge. Ovipositor without spines.

TYPES.—Holotype, female, and paratype, female, Coyote Mts., Arizona, August 4–7, 1916, about 3500 alt.

Paratype in the Philadelphia Academy of Sciences.

MALLOPHORA Macquart

TABLE OF SPECIES

1. Abdomen not wholly black-haired. . . . . .2.
   Abdomen wholly black-haired (Minnesota, Florida) . . . . . .*nigra* Williston.
2. Apical abdominal segments wholly black-haired, contrasting with the pale-haired basal segments. . . . . 3.
   Apical segments largely or wholly pale-haired . . . . 8.
3. Scutellum and abdomen with yellow hair . . . . 4.
   Scutellum and abdomen with reddish hair (Arizona) . .*fulva* Banks.
4. Basal four abdominal segments pale pilose. . . . . .5.
   Basal two or three segments pale pilose. . . . . .6.
5. Venter black pilose (U. S.) . . . . *orcina* Wiedemann.
   Venter yellow pilose (Cuba) . . . . *macquarti* Rondani.
6. First and second segments with bands of whitish pile (Cuba) .*bruneri* Bromley.
   First three abdominal segments yellow pilose. . . . . .7.
7. Arista about equal in length to third antennal segment; male genitalia black-haired (S. E. States) . . . .*rex* Bromley.
   Arista twice as long as third antennal segment; male genitalia yellow-haired (Mississippi, Georgia). . . . .*chrysomela* Bromley.
8. Basal three and apical two abdominal segments white-haired, the intermediate segments black-haired. . . . . .14.
   All the abdominal segments with pale hair dorsally. . . . . .9.
9. Propleura entirely yellow-haired. . . . . .10.
   Propleura with only a few scattered yellow hairs amidst black or brown pile.
   fautrix Osten Sacken.

10. Mesonotum black-haired behind the suture.......... .... .11.
    Mesonotum with conspicuous yellow hair behind the suture, especially at the sides....... .. ..12.
11. Posterior tibiæ of male yellow-haired on basal half of inner ventral surface (California)...... ....*fautricoides*, n. sp.
    Posterior tibiæ wholly black-haired in both sexes (Texas) ...*bromleyi*, n. sp.
12. Femora broadly reddish basally (widespread).......... *guildiana* Williston.
    Femora black, the apices may be reddish.. .... .13.
13. Posterior tibiæ black-haired dorsally on whole length (Kentucky to Florida). *laphroides* Wiedemann.
    Posterior tibiæ yellow-haired on basal half (widespread)..*clausicella* Macquart.
14. Mesonotum black-haired; large species, over 20 mm. in length (Georgia, Florida).... . ... *bomboides* Wiedemann.
    Mesonotum mostly yellow-haired; small species, under 12 mm. in length (Kentucky to Florida)...... ....*laphroides* Wiedemann.

Mallophora fautricoides, new species

Related to *fautrix* Osten Sacken but the pleura pale-haired except for scattered black hairs on the median portion and mesopleura. Length, about 18 mm.

MALE.—Head black; lower half of face, basal two antennal segments and the arista, reddish. Pile yellowish white, a few black hairs on the sides of the face below; palpal pile whitish.

Thorax blackish with brownish pollen, the lateral margins of the mesonotum reddish in ground color. Pile of mesonotum black; an anterior band and a broad median vitta on the anterior half and the sides before the suture, short, whitish haired; pile of prothorax and hypopleura whitish. Scutellum with yellowish white pile.

Legs castaneous, black-haired; coxæ and the ventral surface of the posterior tibiæ on the basal half, whitish pilose.

Wings light brown. Squamæ brown, with brown fringe, the upper lobe with white fringe. Halteres brownish red.

Abdomen clothed with pale yellowish hair above and below.

HOLOTYPE.—Male, San Diego, California, August 4, 1917, (W. S. Wright).

The color of the pale pile in this species is much lighter than in *fautrix*. The basal segment of the posterior tarsus is less swollen, etc.

Mallophora bromleyi, new species

Allied to *fautrix* Osten Sacken but at once distinguished by the yellow pilose propleura. Length, 14 to 18 mm.

MALE.—Head black, yellow pilose, a few black hairs on the sides of the front; lower half of face reddish brown to brownish red; basal two antennal segments and the arista reddish.

Thorax dull black; thinly brownish pollinose; mesonotum black-haired except a narrow band of short yellow hair in front, a weak, broad median vitta on the anterior half and a few scattered hairs laterally; pleura with dense yellow pile in front and behind and with scattered yellow hairs mixed with the black on the intermediate portion. Scutellum yellow pilose.

Legs castaneous, black-haired except a few yellow hairs on the apical two segments of the posterior tarsi, the bases of the femora and the coxæ.

Wings pale brownish. Squamæ brown with brown fringe, the upper lobe with yellow fringe. Halteres reddish brown.

Abdomen wholly clothed with yellow pile.

TYPES.—Holotype, male, allotype, female, and one male and two female paratypes, Marathon, Texas, July 1–2, 1916.

Types in American Museum of Natural History; paratypes in Philadelphia Academy of Sciences.

SYRPHIDÆ

Syrphus catalina, new species

Related to *laxa* Osten Sacken but the lower fourth of the front is reddish yellow and the legs are much less black. Eyes pilose; second and third reddish yellow abdominal bands entire; third vein moderately curved into the apical cell. Length, 12 to 13.5 mm.

FEMALE.—Face, cheeks, and lower fourth of the front reddish yellow, the face with a rather narrow median brown vitta on the lower half; face concave above, retreating below the tubercle. Front bronze-black, very widely yellow pollinose laterally on more than the lower half, the pollen forming an entire band across the middle, the ground color beneath it reddish toward the orbits. Pile of front and middle of face black, elsewhere yellowish white. Arista brown, the third segment large, oval; arista reddish on basal third. Pile of the eyes short and whitish.

Mesonotum æneous, with three weak, gray pollinose vittæ on the anterior half; the lateral margins diffusely reddish. Pile very pale yellowish, yellow laterally. Scutellum yellow, translucent, the apical half with black hair. Pleura greenish black thinly pale pollinose; with a broad arch of yellow extending over the mesopleura, sternopleura, and to beneath the squamæ, the pale color largely concealed by whitish pollen.

Legs reddish yellow; coxæ and bases of femora brown, the posterior femora sometimes brown on the basal half; posterior tibiæ sometimes with a narrow median brown ring; fourth and fifth segments of the tarsi and sometimes the third on the apical half or more, brownish. Hair black, the anterior four tibiæ and tarsi wholly yellowish haired.

Wings cinereous hyaline, with brownish tinge anteriorly and apically. Stigma pale brownish. Squamæ whitish, with yellow border and fringe. Halteres reddish yellow.

Abdomen black, with four or five dull orange fasciæ, that on the second segment interrupted in the middle and with the inner border of the spots convex, the anterior border touching the anterior margin broadly at the sides; band on third and fourth segments very narrowly separated from base of segments, deeply emarginate in the middle behind and narrowed at the sides posteriorly; fourth segment broadly reddish apically; fifth reddish with a gently arched, incomplete, shining black fascia. Abdomen rather dull, with the first segment, lateral margins and apices of the second to fourth segments shining. Black areas black pilose, the first segment wholly, basal half of the second, the broad reddish fasciæ and more or less of the fifth segment, yellow pilose. Reddish bands broader than the black fasciæ. Venter reddish with entire, medianly broadened black fasciæ.

Types.—Holotype, female, and three paratypes, Bear Wallow, Santa Catalina Mts., Arizona, July 12 to 17, 1916, (F. E. Lutz).

Paratypes in the Philadelphia Academy of Sciences.

Callostigma hyalipennis, new species

Differs from *elnora* Shannon in lacking a brown spot at the apex of the wing, wholly yellow scutellum, etc. Length, 5.75 mm.

Female.—Face yellow, perpendicular, strongly receding below the tubercle; pile yellow. Front pale orange, the upper fourth, a median vitta and a small lunular spot shining black, the vitta becoming ferruginous on its anterior third; pile black, yellow on the sides of the lower half. Ocellar triangle slightly shorter than wide. Occiput black, densely cinereous pollinose, vertex more yellowish; pile pale yellowish, short. Antennæ reddish yellow; third segment a little longer than wide, rounded apically, the arista brown, about as long as antenna.

Thorax yellow, the median three-fifths of the mesonotum bronze-black, outside the grayish-yellow pollinose vittæ with strong purplish reflections; median pollinose vitta narrow, not reaching the scutellum, the outer ones shorter, wider and gently diverging posteriorly. A broad, shining black band extends from the metanotum to the mesosternum Pile yellow, black on the apex of the scutellum which is pale orange dorsally.

Legs yellow, the tarsi and a broad, preapical band on the posterior femora more reddish.

Wings cinereous hyaline; stigma luteous. Apical cross-vein straight, transverse, with long appendage at its posterior end; posterior cross-vein practically straight, oblique, with long appendage behind. Squamæ reddish yellow, the upper lobe with pale brown border. Halteres pale orange.

Abdomen orange with blackish markings First segment yellow with a broad, brown posterior fascia which is narrowed medianly and does not reach the lateral margins. Second segment with the posterior fifth black and with a sub-basal brown fascia which is narrowed on either side of the middle and narrowly separated from the lateral margins. Third segment with the posterior sixth black, the black expanded laterally and with an anteriorly produced spur, in the middle in front with an elongate black spot, the remnant of the median vitta. Fourth segment on either side with a sub-triangular black spot which reaches almost to the base of the segment, its inner edge straight, a narrow median vitta and a posterior black fascia which is broadly separated from the black lateral spots. Fifth segment with three black vittæ the outer ones expanding posteriorly to reach the lateral margins broadly; sixth segment wholly black. Pile short, appressed, sparse and black, yellow on lateral margins and first segment.

Holotype.—Female, Tegucigalpa, Honduras, March 30, 1917, (F. J. Dyer).

Lycastrirhyncha mexicana, new species

Differs from *nitens* Bigot in having four linear vittæ on the central part of the mesonotum. Length, including snout, about 9 mm.

FEMALE.—Head black, the apical half of the snout blue-black; head with yellowish-gray pollen, that on the apical half of the snout and the front thin, the basal part of the snout on the upper surface and a large spot on the front of the cheeks, bare. Pile whitish, the occipital cilia and frontal pile black. Front across the middle with three triangular, opaque-black spots, the median one elongate and reaching nearly to the base of the antennal prominence; a shining black spot extends from each outer ocellus to the posterior corners of the eyes and there is a small opaque-black spot behind each of the posterior ocelli. Antennæ reddish.

Thorax metallic bluish or greenish black, with thin gray pollen, the mesonotum with six black vittæ, the two outer ones of the median four united posteriorly, the outer ones geminate, united in front, broadly interrupted at the suture. Posterior calli dull brown. Scutellum with a large reddish spot on the disc, opaque brown between this spot and the basal corners, the base shining. Pile pale yellowish, with scattered black hairs on the posterior calli and scutellum.

Legs blackish, apices of femora reddish; basal third or less of the tibiæ and the basal segment of the anterior tarsi reddish yellow.

Wings hyaline; veins brown. Squamæ white. Halteres yellow.

Abdomen shining black, slightly bronzed, with opaque black and orange markings. First segment with a small opaque-black spot toward either side; second with a large, rectangular opaque-black spot in the middle extending from the base to the apical third and sometimes produced to unite with a roundish opaque-black spot at the posterior lateral third, the lateral margins broadly shining black, the intervening space orange. Third segment with small, obscure reddish spot on either side at the base, in the middle basally with an oval opaque-black spot and posteriorly, toward the side with a small round spot of the same color. Fourth segment with an opaque-black basal triangle and larger, roundish spots posteriorly. Fifth segment with a small opaque triangle at the base in the middle. Pile very short, pale yellowish.

TYPES.—Holotype, female, Vera Cruz, Mexico, April, (H. H. Smith); paratype, female, Vera Cruz. Both specimens are from the Williston Collection.

These specimens were evidently before Williston when he wrote his description of *nitens* Bigot for the 'Biologia,' although in the description he states that the femora are reddish basally and he makes no mention of the red spot on the scutellum and mentions only an opaque-black spot on the sides of the front; in one specimen the median spot is only faintly indicated; in the same specimen the anterior section of the outer opaque-black vitta on the mesonotum is solid black. There are so many discrepancies between these specimens and the description given by Bigot that they must be referred to a different species. A key to the species will be included in a paper to be published later.

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NEW SYRPHIDÆ FROM CENTRAL AMERICA AND THE WEST INDIES

By C. H. Curran

Since the publication of my synopsis of the Volucellinæ,[1] six additional species have come to hand and are among the new forms characterized in the following pages. Identification of these should not be difficult as they are compared with the species to which they trace in the key. I am greatly indebted to Dr. Joseph Bequaert for his generosity in donating the types of new species, from his collection, to The American Museum of Natural History.

Megametopon violacea, new species

Readily distinguished from *nasicum* Williston by its greenish abdomen with brilliant violaceous opalescence. Length, 8 to 9 mm.

MALE.—Head varying from waxy brownish yellow to reddish yellow, the occiput black in ground color; cheeks brownish posteriorly and with a black or brown stripe extending from the eye to the oral angles. Pile whitish with yellow tinge, the upper fourth of the front with scattered black hairs except in the middle. Antennæ brownish red; arista brown on apical half.

Mesonotum green, with strong violaceous opalescence, the sides broadly brownish. Scutellum blue-black, its disc dull. Pleura greenish black, the prothorax, a broad band extending from the base of the wing to the middle coxæ and the hypopleura, yellowish. Pile cinereous, short, dense anteriorly; mesonotum behind with longer yellow pile, a row of fine bristles and some scattered black hairs; bristles of thorax black.

Coxæ brown, pale pilose. Femora broadly brown or black basally and on almost their whole length in front, reddish apically; tibiæ black or dark brown, their bases broadly dull reddish; tarsi brown, the posterior four becoming paler basally, the anterior pair black. Pile black; yellow on the posterior surface of the anterior four femora and on the posterior pair except dorsally and on the broad apex.

Wings tinged with brown or yellowish brown, especially along the veins, rarely hyaline posteriorly and in the cells of the apical half of the wing. Squamæ grayish white, the fringe mostly black. Knob of halteres white.

Abdomen green, brilliantly violaceous in some lights; first segment and more than the basal third of the second on the median two-thirds, reddish yellow, and often with a less conspicuous, roundish spot toward either side in the green field. Pile short and whitish, the apical third of the second and third segments with black pile except laterally. Venter with the basal half yellowish, the apical half black, and wholly pale pilose. Genitalia brown, thinly pollinose, black-haired.

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[1] American Museum Novitates No. 413.

FEMALE.—Front moderately wide, rather gently widening from vertex to face; upper brown orbital spot opposite the antennæ absent; antennæ situated only a little below the middle of the eyes; a broad band of black pile across the ocellar region; face perpendicular below the tubercle.

TYPES.—Holotype, male, allotype, female, and nine male paratypes, Chichen Itza, Yucatan, Mexico, June, 1929, (J. Bequaert).

There is but one other species in the genus, *nasicum* Williston, known only from Mexico. It lacks black hair on the head and has the abdomen pale-colored. The female differs very markedly from the male in the structure of the head but agrees so well in every other respect that I am placing it here. The antennæ are situated higher than in the female of *nasicum*. The head appears ludicrously broad, being broader than the thorax and very short.

Copestylum bequaerti, new species

Apical two segments of the abdomen ferruginous or reddish; wings luteous on basal half in front of the sixth vein and with a large, deep brown spot beyond the middle. Length, 10 to 11.5 mm.

MALE.—Head black, the face broadly reddish yellow on either side. Pile pale brassy yellow, appressed on the face, short and tawny on the eyes; vertical triangle black-haired. Occiput and narrow sides of the face whitish pollinose. Antennæ brown; arista deep black.

Thorax shining black; humeri, posterior calli and scutellum brownish, or at least tinged with brown. Pile black; in front of the suture and on the meso- and sternopleura brassy yellow; scutellum with black pile, the base and a narrow apical border yellow pilose.

Legs black; tips of femora brown; pile black; coxæ pale pilose.

Very broad apex and posterior border of the wing hyaline. The luteous color fills out the whole of the anal cell and extends somewhat into the auxilliary cell. The apical border of the brown spot lies a little beyond the anterior cross-vein and is transverse; the brown color, extending from the costa to behind the fourth vein, forms a broad cloud over the discal cross-vein and extends as a narrow wedge to the basal fourth of the first basal cell. Squamæ luteous, with shining brownish yellow fringe. Knob of halteres white.

Basal two abdominal segments black, the apical two ferruginous; sides of second to fourth segments reddish. Pile white on the first segment; second segment with black pile, on either side with a large subrectangular area of white pile which extends narrowly inward along the base of the segment, forms an acute angle posteriorly at the inner end and is more or less convex on its outer edge; sides broadly golden pilose except basally. Third segment black pilose, the base narrowly white, the sides broadly golden. Fourth segment with sparse yellow pile and with appressed, very short black hairs over almost its whole surface, the sides golden pilose. Genitalia reddish, yellow pilose. Venter shining black, with obscure reddish markings basally and apically on the third sternite; pile black, the second to fourth sternites each with a broad, transverse spot of yellowish pile in the middle.

Types.—Holotype, male, and one male paratype, Chichen Itza, Yucatan Mexico, June, 1929, (J. Bequaert).

In my recently published key to this genus (American Museum Novitates, No. 413) this species will trace to *limbipennis* Williston, but in that species the brown color extends to the apex of the marginal cell, whereas in *bequaerti* it stops near the middle of the discal cell.

Volucella Geoffroy

Since the publication of the key to the species of *Volucella*, in American Museum Novitates No. 413, some additional material has come to hand, resulting in a further study of some of the forms. I find that I have previously confused two species under *eugenia* Williston and a third related species is before me from the Bahamas. The species in this group may be separated as follows.

1. Mesopleura entirely black-haired 2.
   Mesopleura with cinereous yellow pile above *watsoni*, n. sp
2. Scutellum with more than the apical half black-haired 3.
   Scutellum yellow pilose, at most a few of the bristly hairs on the margin black. *abdominalis* Wiedemann.
3. Notopleura and scutellum wholly black pilose. *ingenia*, n. sp.
   Notopleura and broad base of scutellum reddish yellow pilose *eugenia* Williston.

Volucella watsoni, new species

Abdomen violaceous black; scutellum reddish brown, black pilose. Length, 16 to 19 mm.

Male.—Head black; face and frontal triangle yellow, pale yellow pollinose; pile pale yellow. Antennæ reddish, the third segment mostly brown, rather kidney shaped; arista black. Face strongly produced downward, moderately concave above, the tubercle low and over one-fourth as long as the face.

Thorax black, the sides of the mesonotum broadly brownish red. Pile of the mesonotum and upper half of the mesopleura cinereous yellow; pleura, posterior calli and scutellum black pilose, the latter without distinct bristles; no prescutellar bristles.

Legs black; tibiæ red on basal three-fourths; pile black.

Wings hyaline; yellowish on the basal half except posteriorly and also along the costa beyond the subquadrate brown spot which extends from the costa over the cross-veins at the middle of the wing. Squamæ and their fringe brown. Knob of halteres white.

Abdomen brownish black or violaceous black, in some lights with violaceous reflections. Pile wholly black. Venter violaceous.

Female.—Middle of front brownish on whole length, the vertex reddish; front wholly brownish yellow pollinose except at the vertex; pile wholly pale yellowish. The front is narrow above and gently widens to the level of the antennæ.

TYPES.—Holotype, male, Port-au-Prince, Haiti, March 5–11, 1922; allotype, female, La Moriniere, Haiti, March 1–5, 1922; paratypes, three males, Port-au-Prince, February 2 to 28, 1922, and one male, Pont Beudet, Haiti, March 3–4, 1922. The specimens were all collected by F. E. Watson.

Volucella ingenia, new species

Abdomen steel-blue; scutellum wholly black-haired. Length, 15 mm.

FEMALE.—Head black, the posterior orbits gray pollinose. Face and front brownish yellow, the former yellowish pollinose, the latter with little evidence of pollen. Pile yellowish, on the facial tubercle and at the vertex black. Antennæ reddish, the third segment narrowed on apical half; arista with black apex and rays. Face strongly produced downward, moderately concave above, the low tubercle more than one-fourth as long as the face. Eyes with short white pile.

Thorax black, the sides and scutellum reddish brown. Pile black, yellow on the mesonotum in front of the suture and also immediately in front of the scutellum.

Legs black; tibiæ reddish with the apical fifth or less brown; pile wholly black.

Wings pale orange on almost the basal half in front of the sixth vein and on the whole length in front of the second vein; the median cross-veins broadly clouded with brown, the longitudinal veins on the apical half of the wing from the fourth to the sixth margined with brown except apically. Squamæ and fringe blackish. Knob of halteres white.

Abdomen steel-blue, with violaceous reflections in some lights, wholly black pilose.

HOLOTYPE.—Female, Gibson Cay, Mangrove Cay, Andros Island, Bahamas (J. Bequaert).

Volucella feminina, new species

Related to *unipunctata* Curran but the legs are black, the tarsi reddish yellow basally. Length, 5 mm.

FEMALE.—Head black, sides of face very broadly whitish yellow; the pale color occupies the sides of the face between the orbits and base of antennæ and tapers below, not reaching the oral margin; it is continued much less narrowly along the orbits to above the middle of the front; cheeks with a narrow reddish stripe across the middle from eye to oral margin. Pile yellowish white; black on the upper fourth of the front. Occiput cinereous pollinose. Face perpendicular, strongly produced downward; below the middle with a low tubercle which is receding from near its upper end to the oral margin. Antennæ brown; third segment regular in outline; arista luteous, with black apex and rays.

Thorax shining black; humeri, notopleura, a small spot above the front coxæ and a transverse, oval spot in front of the scutellum, whitish yellow. Pile pale yellowish, on the mesonotum intermixed with black and becoming wholly black on the posterior fourth. Scutellum translucent brownish yellow, on either basal corner with a rather oval whitish-yellow spot; pile black, abundant, pale yellow on the narrow base and the sides basally.

Legs black, with abundant black pile. Basal two segments of the tarsi reddish yellow and with similarly colored pile.

Wings cinereous hyaline with pale brown fasciæ; the basal fascia extends over the cross-veins at the apex of the second basal cell to the fork of the third vein; the second fascia extends back from the apex of the first cell to the posterior end of the posterior cross-vein; the third fascia fills out almost the apical fourth of the wing, becoming paler apically and extending broadly as a grayish cloud along the whole posterior border of the wing. Marginal cell strongly bulbous apically. Squamæ grayish white, with whitish fringe. Halteres white.

Abdomen shining black, the third segment with a pair of large, poorly defined reddish spots. Pile rather short, white; black on the posterior half of the second segment; partly brown on the reddish spots. Venter shining black and clothed with black pile.

HOLOTYPE.—Female, Chichen Itza, Yucatan, Mexico, June, 1929, (J. Bequaert).

Volucella ernestina new species

Bright green, including the face; scutellum with preapical depression; no prescutellar row of bristles; fourth abdominal segment mostly brownish-yellow pilose. Related to *ernesta* Curran from which it differs in having longer black hairs intermixed with the yellow pile on the mesonotum. Differs from *viridana* Townsend in having the fourth abdominal segment pale pilose. Length, 8 mm.

MALE.—Head green, cheeks with a brownish-red triangle extending from the oral margin to the orbit. The grayish occipital pollen has a brownish tinge; a broad band of white pollen across the facial depression, the lateral margins of the face similarly pollinose. Pile fine, white; black on the middle of the face and on the vertical triangle. Face strongly produced downward, deeply concave above, with a strong tubercle a little below the middle, its most prominent point on a level with the lower border of the eyes, below the tubercle perpendicular. Antennæ reddish brown; third segment with parallel sides on apical two-thirds, rounded apically; arista luteous, with black rays and apex. Pile of eyes fine, whitish, rather short and not dense.

Thorax green; mesonotum, except on the sides in front, somewhat dulled and with conspicuous opalescence. Humeri brownish. Pile rather tawny, on the pleura paler, on the mesonotum with longer black hairs intermixed; scutellum with black pile laterally and with black marginal bristles, dulled except on its free border. There is some black pile on the pteropleura.

Legs black; tarsi brown, obscurely reddish basally; femora green beneath; pile wholly black.

Wings hyaline, the veins all bordered with yellowish brown; a small darker spot at the base of the stigma; marginal cell petiolate, convex apically and scarcely widened. Squamæ grayish, with brownish border and fringe. Halteres white.

Abdomen brilliant green, with slight coppery reflections in some lights. Pile white on first segment and basal half of second except laterally; from lateral view the pile on the rest of the abdomen appears obscure tawny, from dorsal view it appears more yellowish; on the lateral margins there are black hairs intermixed and these are conspicuous near the base of the second segment. Venter pale pilose, the apical third and genitalia with black pile.

HOLOTYPE.—Male, Chichen Itza, Yucatan, Mexico, June, 1929, (J. Bequaert).

Microdon apiculus, new species

Belongs to the sub-genus *Ubristes* Walker. Differs from *micromidas* Shannon in having black legs and thorax. Length, 8 to 9 mm.

MALE.—Head black, the sides of the face very broadly yellowish white, almost stramineous laterally, the median black vitta tapering below. Face narrow, widest just below the antennæ, whitish pilose; in profile gently receding below, almost straight. Front narrow below, widening to the vertex, the depression moderately deep, the upper section of the front swollen; ocellar triangle longer than broad, swollen, situated at the middle of the upper section of the front; hair rather short, erect, abundant, black. Occiput with yellowish-white hair on lower half, and more abundant black hair above. Eyes bare. Labellæ bright orange. Antennæ brown, longer than the head, the third segment one eighth longer than the first; arista slender, shorter than the first segment.

Thorax shining black, a large spot on the sternopleura above and an indefinite area above the front coxæ yellowish brown Pile black, an undulate anterior band on the mesonotum, a small spot at the inner ends of the suture, a very broad prescutellar band and the scutellum wholly, golden-reddish pilose. Scutellum short, shallowly and narrowly emarginate at the apex, leaving a pair of small tubercles.

Legs shining black; the apical two segments of the tarsi reddish; pile black; on the dorsal surface of the tibiæ, white on basal half or less, long on the posterior tibiæ and tarsi.

Wings tinged with blackish brown; beyond the end of the subcostal vein with an elongate, rectangular paler area which is more conspicuous in the female, the veins within this area yellowish. Squamæ and halteres brown, the base of the latter orange.

Abdomen strongly narrowed and tapering beyond the second segment; orange or rusty reddish, with short yellow pile, the sides of the basal two segments black pilose, a basal triangle on the sides of the fourth segment whitish pilose. Genitalia small, rather ferruginous.

FEMALE.—The front widens gently from opposite the anterior ocellus to the base of the antennæ and the frontal depression is less impressed. Fifth abdominal segment brown dorsally, the ovipositor brown with yellow apex. The pale spot on the wing is a little whitish in some views and extends back as far as the fourth vein and along the costa to a point only a little before the stump of vein in the apical cell.

TYPES.—Four specimens from Barro Colorado Island; holotype, male, January 7, 1929; allotype, female, February 13, 1929; paratypes, two males, January 5 and 10, 1929, (Curran).

This species very closely resembles certain bees of the genus *Trigona*. All the specimens were taken along the trails: two on Lutz trail, near the laboratory, one on Snyder-Molino trail, and one on Wheeler trail, near its junction with the last mentioned.

Microdon panamensis, new species

A small species with strongly elevated, deeply sulcate scutellum, the abdomen of the male mostly blackish, of the female mostly pale orange. Antennæ very long. Length, 7 to 8.5 mm.

MALE.—Head brownish black, the face yellow on more than each lateral third, the yellow ground meeting above the oral margin; facial pile very short, appressed, brassy yellow, the sides of the face narrowly white pollinose; face widening very slightly on the lower half. Front slightly narrowing to the vertex; no distinct frontal depression, but the upper section strongly convex and with the ocellar triangle, which is wider than long, lying mostly before its middle; front with thin brownish pollen and appressed, very short, golden hair except on the ocellar triangle and a small orbital triangle occupying the lower fourth of the upper section; ocellar triangle not at all swollen, a shallow groove extending from the anterior ocellus to the anterior edge of the upper section Occiput with thin cinereous pollen which becomes brownish yellow above the pile short and white below, reddish or tawny toward the vertex. Antennæ brown the third segment a little more than one-third longer than the first, narrowed apically, the second short, but little longer than wide; arista about three-fourths as long as the first segment

Mesonotum rather dull brownish black, with very short closely appressed black hair; golden hair forming three bands, the anterior one situated on the anterior margin, interrupted, the median one narrowest and entire, posterior band widest, situated on the posterior border, irregularly margined in front. Humeri and scutellum orange the latter rather dulled apically by the very short, appressed reddish-yellow hair, the apical border with coarser black hair, its apex with a very deep impression which leaves a large, mammiform process on either side, the scutellum directed obliquely upward. Pleura shining blackish-brown with a band of silvery pile extending from the notopleura to the middle coxæ.

Legs shining blackish, the apical fifth of the anterior four tibiæ obscurely reddish; tarsi reddish except the basal segment of the posterior pair, the basal segment with a small basal tubercle beneath and grooved for the reception of the following segment in repose, the second segment more or less carinate beneath. The brownish coxæ bear thin gray or whitish pollen and short, appressed white hair; tarsi with short yellow hair, the first segment of the posterior pair black-haired above; hair of femora and tibiæ extremely short and appressed, the femora little swollen, all the tibiæ gradually increasing in size from base to apex.

Wings cinereous hyaline, the cross-veins bordered with brown; apical cross-vein transverse, an appendage at its posterior end. Squamæ whitish, with narrow brown border and fringe. Halteres yellow.

Abdomen brownish black, with yellow markings. Second segment on either side with a large pale triangle which is continuous with a broad pale vitta on the third segment, the very broad apex of the third segment, except at the sides, yellowish, the base more or less yellow; fourth segment with the posterior border broadly yellow. Pile very short, golden yellow, on the fourth segment less abundant and more brassy. Second to fourth sternites brownish yellow with pale-yellow apices.

FEMALE.—Front a little wider. Scutellum with black hair only. Tibiæ considerably more swollen, the anterior four reddish apically. Wings more nearly hyaline, the veins mostly reddish yellow. Abdomen orange, the lateral margins brownish except on the apical half of the fifth segment, the brown part with black hair. Venter reddish yellow. Tip of ovipositor black.

In the male the second abdominal segment is elongate, being almost as long as the third and fourth together, and it is not greatly widened apically where it is, however, almost as wide as the third segment. This gives an elongate, subcylindrical appearance to the abdomen. In the female the abdomen is much more oval, the second segment strongly widening from the base to the apex and much shorter than the third and fourth segments combined. Another unusual character is the very marked differentiation of the abdominal sutures, with no indication of fusion.

TYPES.—Holotype, male, allotype, female France Field, January 18, 1929. (Curran); taken in coitu.

Microdon solitaria, new species

Metallic bluish-green; legs green, tibiæ white-haired, scutellum armed. Length, 10.5 mm

FEMALE.—Face rather narrow, with almost parallel sides, the pile long and whitish and continuing along the orbits to the lower fourth of the front. Front black pilose, with almost parallel sides on upper three-fourths, rather strongly widening below, the depression obsolete or very weak, ocellar triangle small, longer than wide, strongly convex, situated a little behind the middle of the front. Occiput whitish pilose. Proboscis brown. Eyes bare. Antennæ elongate, black, the third segment one-fifth longer than the first, cylindrical, with a narrow groove along the outer side, first segment more or less metallic green above and below. Arista black, about as long as the first segment.

Thorax with moderately long, fairly sparse whitish hair, the disc of the mesonotum with black hair intermixed. Scutellum broadly and shallowly concave apically, a strong, brown-tipped spine on either side of the concavity, the sides gently convex.

Legs metallic green or blue; tarsi brown with the apical segment reddish; pile yellow on the femora, silvery white on the tibiæ, black on upper surface of basal three segments of the posterior tarsi.

Wings cinereous hyaline or tinged with brown, the cross-veins bordered with brown. Apical cross-vein straight, recurrent, with a short appendage at the posterior end.

Abdomen with whitish pile, the third and fourth segments each with a very large, oval oblique spot on either side which fuse anteriorly in the middle and are united with a broad median vitta, the fifth segment black haired except the broad basal corners. Tip of ovipositor red. Second segment in the middle not longer than the first, convex laterally, without sublateral depressions, the shape as in *tristis* Loew.

TYPES.—Holotype, female, Barro Colorado Island, January 3, 1929; paratype, female, February 13, 1929, (Curran).

Callostigma panamensis, new species

At once distinguished from *elnora* Shannon by the absence of the blackish spot at the apex of the wing. Yellowish, with black markings. Length, 5.75 mm.

FEMALE.—Face perpendicular, strongly receding below the tubercle, yellow, with very fine, sparse yellow pile. Front yellow, the upper fourth, a median vitta reaching more than halfway to the antennæ and a small spot on the lunula, shining black, the pile black except on the sides of the lower half; ocellar triangle longer than wide. Occiput blackish, densely cinereous pollinose, toward the vertex with yellow pollen; pile pale yellow. Third antennal segment wider than long, subquadrate, narrowly brown above; arista brown longer than antenna.

Thorax yellow, the median three-fifths of the mesonotum bronze-black, with three grayish-yellow pollinose vittæ, none of which reach the posterior margin, the lateral ones shorter, wider and somewhat diverging posteriorly. Metanotum, a spot on the metapleura and another in front of the posterior coxæ, shining black; an obscure, ferruginous spot in front of either middle coxa. Pile yellow, the pleura bare, scutellum with reddish tinge dorsally and a few black hairs apically.

Legs yellow, tarsi reddish yellow; pile wholly yellow. Wings cinereous hyaline; apical cross-vein transverse, with short appendage at its posterior end; posterior cross-vein oblique on anterior half. Squamæ yellow with brownish tinge. Halteres reddish yellow.

Abdomen pale orange with black markings. First segment yellow with the apex broadly black except at the sides. Second segment with the posterior fourth, an incomplete, narrow fascia on the basal fifth and indications of a slender median vitta, blackish or brown, the median vitta in front of the anterior fasciæ broad and distinct. Third segment with the posterior fifth, a median vitta and a rectangular spot on either side forming a production of the posterior fascia and produced forward from its inner end to the basal third of the segment, blackish; fourth segment in general with similar markings but the posterior fascia is sub-interrupted leaving the lateral rectangular spots more conspicuous and they are longer and more broadly produced forward. Fifth segment with three black vittæ, the outer ones broad and gently concave on their outer edge. Sixth segment with the posterior border narrowly, triangularly produced toward either side and an entire median vitta blackish. Pile short, appressed, black, yellow on the base and lateral margins.

HOLOTYPE.—Female, Barro Colorado Island, January 9, 1929, (Curran).

Differs from *hyalipennis* Curran in having the posterior cross-vein straight and oblique, an oblique black band on the pleura posteriorly, wholly black sixth abdominal segment, etc.

Xanthandrus mexicanus, new species

Related to *bucephalus* Wiedemann but at once distinguished by the entirely black pilose front in the female. Length, 10 to 11 mm.

FEMALE.—Head silvery pollinose; the tubercle, a small spot on the cheeks, and the front, shining black; frontal orbits with a large pollinose spot at the lower third, these sometimes obscurely joined in the middle, but in most lights appearing broadly separated Pile white, on the front and middle of the face above, black. Antennæ brownish red, the third segment black on more than the upper half; arista luteous.

Thorax shining black; pleura, notopleura and humeri cinereous white pollinose and white pilose, the dorsum cinereous pilose; scutellum bordered with blue. The tubercular swellings inside the notopleura are strongly developed.

Legs black; tips of the femora and narrow base of the posterior tibiæ reddish; basal third or less of the anterior and the basal half and apex of middle tibiæ yellow. Pile black; whitish on the posterior coxæ, basal half of the posterior femora and the posterior surface of the middle femora.

Wings cinereous hyaline, stigma bright luteous. Squamæ and their fringe whitish, the margin yellow; halteres yellow.

Abdomen shining bluish-black, the second and third segments mostly opaque. Third segment with a pair of basal, broadly separated, orange spots which are convex posteriorly, broadly separated from the lateral margins and reach to the middle of the segment, the space between them blue; fourth segment with a transverse basal orange triangle on either side but these are sometimes much reduced; posteriorly with a broadly interrupted, subopaque or bronzed fascia, the inner ends of the spots convex, the outer ends produced forward. Basal two-fifths of the second segment, the broad lateral borders of the second to fourth and the apex of the fourth always shining. Pile black, appressed, on the base of the abdomen, broad sides of the second segment and basal half of the sides of the third and fourth segments narrowly, whitish.

Types.—Holotype, female, and two female paratypes, Chichen Itza, Yucatan, Mexico, June, 1929, (J. Bequaert).

In all the females of *bucephalus* which I have seen there is a pair of large orange spots on the second abdominal segment and the basal third of the front is white pilose except for scattered black hairs on the antennal tubercle. I believe that *Melanostoma leucephalus* Bigot, from Colombia, is the same as *bucephalus*, the description agreeing with males of that species.

Ceriogaster panamensis, new species

At once distinguished from the described species by the presence of a large, orange prescutellar triangle on the mesonotum.[1] Length, about 8 mm.

Male.—Frontal triangle and face shining yellowish pollinose, a broad, median facial vitta shining black; cheeks brown; occiput pale yellowish pollinose below, becoming brownish yellow above, the pile yellow, the short, spine-like occipital cilia black. Vertical triangle dull black with yellow pollen in front and behind, the pile yellow with a black band across the ocelli. Pile of frontal triangle fine, yellowish. Antennæ brownish red, the third segment mostly brown; arista brown apically.

Mesonotum dull black, finely scrobiculate, with reddish-yellow pollinose fasciæ anteriorly and across the suture, both broadly interrupted in the middle, on the posterior border with a large, triangular orange spot. Hair extremely short, black, the pale markings, with the exception of the anterior fascia, without pile, the hair on the anterior band and humeri pale yellowish or mixed black and yellowish. Scutellum orange pollinose, with short, coarse hairs on the margin and a few scattered ones on the disc, the basal corners dull blackish. Pleura with rather thin silvery-gray pollen and with short, fine silvery-gray pile.

Coxæ silvery-gray pollinose and pilose. Femora shining black or brown, with short, whitish pile, the posterior pair strongly swollen and with short, stout bristles ventrally except toward the base; apices of femora reddish. Tibiæ brown with the basal third or more and their apices, reddish, the posterior pair with small black tubercles on the ventral surface. Anterior tarsi black, broadened and flattened, the posterior four reddish or reddish yellow with the apical one or two segments darker.

Wings strongly tinged with blackish brown, the subcostal cell wholly dark brown. Squamæ brown. Halteres yellow.

Abdomen black, the basal three segments opaque or subopaque dorsally, metallic on the very broad lateral margins, the first and second steel-blue, the third brassy, the fourth wholly brassy. Pile short, brassy yellow, very short and black on the first two segments and a large posterior triangle on the third, the sides pale pilose. Venter pale pilose; genitalia brownish with whitish pile, thinly pollinose.

Holotype.—Male, Barro Colorado Island, January 10, 1929, (Curran).

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[1] **Ceriogaster fascithorax** Williston

Ceriogaster foscithorax (error) Williston, 1888, Trans. Amer. Ent. Soc., XV, p. 286.
Ceriogaster fascithorax Kertesz, 1910, 'Cat. Dipt.,' p. 308.
Ceriogaster fuscithorax Shannon, 1926, Proc. U. S. N. M., LXIX, Art. 9, p. 50.

I base the spelling of the name for this species upon the label which Williston placed upon one of the specimens and, since the thorax is fasciate, there is no reason to doubt but that the name was intended to describe this condition. I believe we are justified in making this correction in spelling in this case, even though Williston never corrected the error.

Meromacrus panamensis, new species

Related to *acutus* Fabricius but the brown of the wings extends in the subcostal cell and anterior half of the first basal cell quite to the base of the wing and the male genitalia are very different. Length, about 16 mm.

Male. Face yellow with a broad median black vitta, the sides whitish pollinose and thickly rich yellow pilose; frontal triangle black, the sides broadly whitish pollinose and clothed with pale yellowish pile. Cheeks brown, thinly pale pollinose. Occiput black in ground color, whitish pollinose and densely rich yellow pilose; vertical triangle black, cinereous white pollinose in front, black pilose; no black occipital cilia; frontal triangle with sparse black hair in middle. Antennæ brown; arista brownish red, becoming pale yellowish apically.

Mesonotum dull blackish posteriorly; humeri and a slender median line with steel-blue tinge, the posterior border, a stripe along the suture, and two spots in front, clothed with rich yellowish tomentum. Pleura blackish, the yellow tomentum extending over the posterior third of the mesopleura and forming a large spot on the sternopleura, a silvery pollinose band on the sternopleura behind the yellow spot; pile pale yellowish. Scutellum black, the immediate apical border translucent honey-yellow. Pile of mesonotum and scutellum black except on the pale spots, the humeri and the narrow sides of the scutellum. Spiracles white.

Legs rusty reddish, the posterior femora mostly black, their tarsi mostly brown. Coxæ black, silvery-gray pollinose. Middle femora with the very short black hair extending from base to apex on the posteroventral surface.

Wings hyaline, the anterior border broadly brown, the costal cell hyaline. Squamæ grayish white, the very broad border blackish or dark brown, the fringe yellowish. Halteres yellow.

Abdomen dull blackish, with very short brown pile which gives a brownish sheen in most lights, the second segment with a pair of transverse, anteriorly concave shining subtriangular spots which are broadly separated from each other in the middle and extend over the lateral margin. First segment, behind the basal corners of the scutellum, with a subtriangular spot of bright yellow tomentum, the third and fourth segments each with a broadly interrupted basal band of similarly colored tomentum; apices of segments narrowly waxy yellow. Genitalia wine red with blackish diffusion and thin gray pollen. Pile on sides of abdomen and venter longer and pale yellowish.

Holotype.—Male, Barro Colorado Island, December 23, 1928, (Curran)

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WEST INDIAN FORMS OF THE FLYING FISH, GENUS *CYPSELURUS*, WITH THE DESCRIPTION OF A NEW SPECIES

BY C. M. BREDER, JR., AND J. T. NICHOLS

In 1928,[1] Nichols and Breder described *Cypselurus monroei*, on the basis of a single young fish 48 mm. in standard length, taken at Cocoanut Grove, Florida. This fish presented some novel differences from other more usual forms of *Cypselurus.* An adult of the same species has recently come into the writers' hands, along with three other flying-fishes collected by Mr. J. G. Smith in 1929, who also kindly supplied the locality data with the specimens.[2] These were brought north in a refrigerated condition and still showed their life colors to a considerable degree. They may be considered by species.

Cypselurus monroei Nichols and Breder

The proportional measurements show surprisingly slight differences between the juvenile type of the species and the present adult specimen (Fig. 1),[3] the description of which follows.

Standard length, 151 mm.; total length, 200 mm.; Sept. 30, 1929; south of Dry Tortugas, Fla.

Head in length, 4.2; depth, 6.0. Dorsal, 13½; anal, 9½. Eye in head, 3.3; snout, 3.6. Lateral line, 56; predorsal scales, 35. Interorbital in head, 3.0; maxillary, 4.0; width of head, 2.0; greatest width of body, 1.9; depth of peduncle, 3.2; barbel, 1.2; lower caudal lobe, 0.7; longest dorsal ray (fifth), 1.5; anal ray (third), 2.7. Pectoral in length, 1.4; ventral, 2.9.

Body not so quadrate as in other species of *Cypselurus* nor so eliptical as in *Parexocœtus*, head narrowed forward and relatively pointed. Ventrals inserted midway between edge of preopercle and base of caudal and midway between tip of upper caudal lobe and tip of lower jaw, with mouth open; dorsal inserted at two-thirds the distance from anterior margin of pupil to caudal base; anal origin behind dorsal origin a distance equal to two-thirds of eye; midway between tip of lower caudal lobe and end of pectoral base. Pectorals reach to scarcely beyond dorsal base; ventrals to scarcely beyond anal base. Dorsal height, 1.2 in dorsal base which is 1.2 in head;

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[1] Nichols, J. T., and Breder, C. M., Jr., 1928, 'An annotated list of the Synentognathi, with remarks on their development and relationships.' Zoologica, VIII, No. 7, June 11, p 432.

[2] These fishes flew aboard the tanker 'Airo,' those of September 30 following a typical fall hurricane.

[3] Figs. 1 to 4, inclusive, have been prepared by Miss Jean Roddan of the N Y. Aquarium staff.

anal height, 1.8 in anal base which is 2.0 in head. A long, simple, fleshy, tapering barbel at right of symphysis (the left one was obviously lost and the scar healed). The right barbel is eliptical in section, pale-colored with a narrow dark fluted membrane on either side, Palatines with fine teeth, vomer with none.

COLOR AND PATTERN ON ICE.—Body bluish above and silvery below, very like *Cypselurus furcatus*. Pectoral membrane jet-black, except between the three innermost rays where it is white and from which radiates a small and scarcely evident area which is dark dusky. The rays are white and show through the membrane they overlay when viewed from above; they show as bright silvery white lines viewed from below. Ventrals white proximally, with the distal seven-tenths abruptly jet-black as though dipped in ink to that point, except for the outer edging of the fin which is white, and a light dusky line on the four first rays running to the axil, which is likewise dusky. Dorsal black, except for the bases of the first six rays which have a light spot about the diameter of eye. Anal clear, except for a light dusky blotch centrally somewhat smaller than the eye. Caudal mottled, dark dusky in ground color with the tips of both lobes white and a band of light nearly at the fin's base which is convex backward and includes both lobes. On the lower lobe there is a light spot just behind this band and farther backward a second. The latter is at the lower edge of the fin.

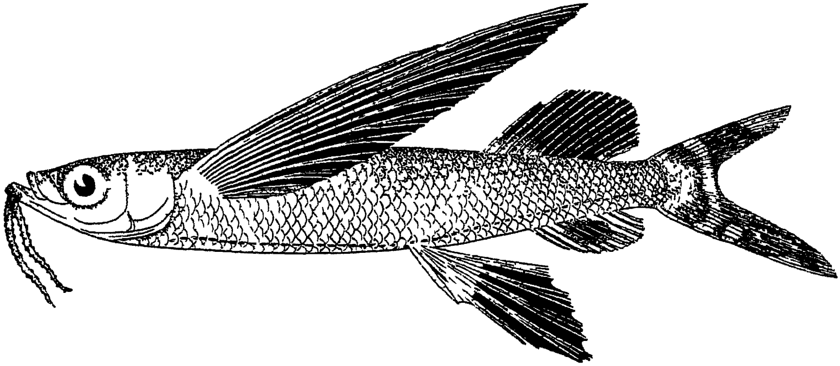

Fig. 1. *Cypselurus monroei* Nichols and Breder. Standard length, 151 mm.

This fish shows very definite evidences of primitive affinities: such as the high, dark dorsal fin which is nearly the size and form of that of *Parexocœtus;* the intermediate type of body cross-section; the sharpness of the snout; and possession of well-developed palatine teeth at this size. Considering these characters, it might be held as the most primitive of the genus, but along with these are other characters which might be taken to be the most specialized to be found in a *Cypselurus*. For example, even as an adult it retains large conspicuous and highly specialized barbels and a caudal pattern evidently related to that of a young *furcatus*, which is shown in Fig. 2 for comparison. This might be taken simply as the retention of primitive larval characters, but, on other grounds which will be treated at another time, such larval characters in this group are believed to be specializations and a retention of them would consequently indicate a continuation of these more recently developed characters into adult life. Furthermore, the very young of the unquestionably more primitive *Parexocœtus* are in all essential respects similar to their adults at all ages.

A species of the Indian Ocean, *Cypselurus naresi* (Günther), known from three specimens of 60, 150, and 160 mm., is apparently close to *monroei*, but the current descriptions are inadequate to clearly determine just how close the resemblance may be. There is no mention in *naresi* of a marked resemblance to *Parexocœtus*, i.e., the elliptical body section, the high dorsal, the small ventrals, etc. It seems unlikely that they would pass unnoticed, if this fish resembled *monroei* in these striking characters. Other relative minor differences are listed below, and in themselves indicate specific distinction. Also, it is strange that a single barbel is mentioned only, and that in this single adult of *monroei* only one remains intact.

	Cypselurus naresi	*Cypselurus monroei*
Total Length (mm.)	60, 150, 175	200
Dorsal	10 to 12	13½
Lateral Line	45	56
Depth	6 5 to 7	6
Head in Total Length	4— to 5+	5.5
Eye	3	3.3
Eye in Post-orbital Part of Head	1±	1.5
Predorsal Scales	27 to 32	35
Ventrals	Black except on middle 4th, or black with inner border white	Black on distal ⅔
Anal	Last ⅓ black	With a central black blotch

A new genus could doubtless be erected for this species, combining as it does primitive and specialized characters, but at present it is considered best to let it stand as an aberrant *Cypselurus*, pending further data.

Cypselurus furcatus (Mitchill)

Standard length, 150 mm.; Sept. 30, 1929; south of Dry Tortugas, Fla.

The colors and pattern of this specimen are so like that of Fig. 175 of Nichols and Breder, showing a specimen of 160 mm. standard length, that comment is unnecessary. The largest barbel is 1.8 in the head, and black except at the base which is white.

Attention is called to the fact that the present specimens of *furcatus* and *monroei* differ by 1 mm., but the caudal patterns are very different, that of *furcatus* being plain dusky, while that of *monroei* resembles that of numerous specimens of *furcatus*, collected at the Carnegie Biological Station at the Dry Tortugas in the early summer of 1929, which ranged from about 60 to 100 mm. Above this size-range it fades to plain dusky, and below, it has not yet appeared.

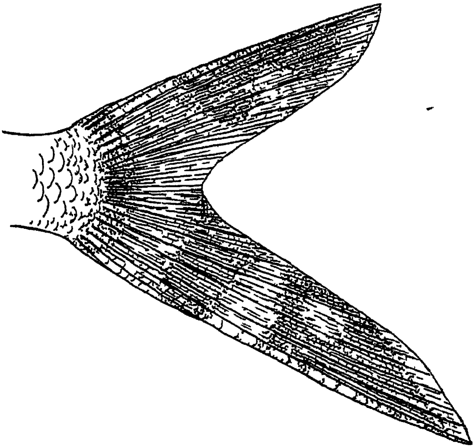

Fig. 2. Caudal of *Cypselurus furcatus* (Mitchill), 70 mm. standard length, showing resemblance of pattern to that of adult *C. monroei*. From a specimen taken at the Dry Tortugas Laboratory of the Carnegie Institution of Washington, D. C., July, 1929.

Cypselurus smithi, new species

Type.—No. 9673, American Museum of Natural History; north of Bahamas, Sept. 30, 1929. Standard length, 200 mm.; total length, 256 mm.

Head in length, 3.9; depth, 6.2. Dorsal, 15½; anal, 10½. Eye, in head, 3.2; snout, 3.3. Lateral line, 45; predorsal scales, 28. Interorbital in head, 3.0; maxillary, 3.9; width of head, 2.8; greatest width of body, 2.7; depth of peduncle, 3.3; lower caudal lobe, 0.8; longest dorsal ray (third), 1.8; anal ray (third), 3.8. Pectoral in length, 1.4; ventral 3.7.

Body quadrate, head blunt. Ventrals inserted midway between posterior margin of eye and caudal base, and midway between base of last anal ray and a point nearly a pupil's length in advance of gill-opening. Dorsal inserted two-thirds the distance from a point midway between anterior edge of eye and pupil and the caudal base. Anal behind dorsal by a distance equal to postorbital part of head, which is equal to snout to nearly center of pupil. Pectorals reach to root of upper caudal lobe, ventrals to first third of anal. Dorsal height, 1.7 in dorsal base which is 1.2 in head; anal height, 2.0 in anal base which is 2.2 in head.

Coloration.—Pectorals with a diffused light band radiating from the inner edge of fin to about three-fourths the way across it. Membranes blue-black, the rays jet, the outer one whitish. Ventrals clear, with dusky rays, darkest proximally, most pronounced on the three central rays. Dorsal clear, with a triangular black distal area on the membranes posteriorly not quite reaching to the base of the fin forward to the ninth ray, its front margin thence vertically upward to the tip of the fourth. A paler dusky spot in this area between ninth and tenth rays. Anal fin is plain. Lower caudal lobe black, upper whitish with a dusky outer margin. This mark is most pronounced in contrast to other similar flying fishes.

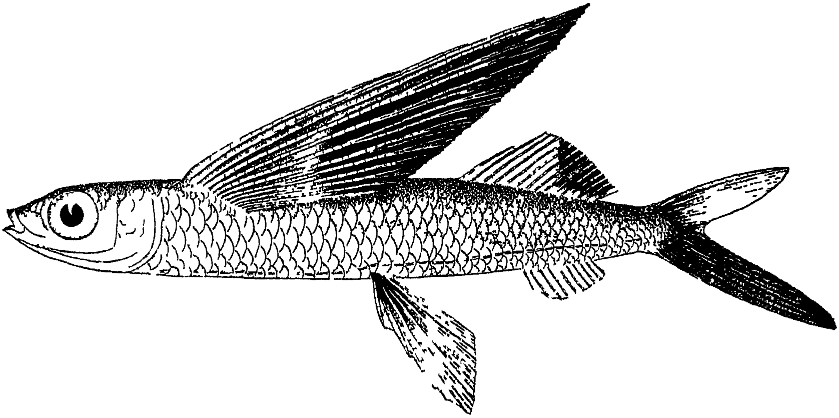

Fig. 3. *Cypselurus smithi*, new species. Standard length, 200 mm. Type.

Named for the collector, Mr. J. G. Smith.

There is one paratype of 151 mm. standard length, Diamond shoal light, Sept. 19, 1929, which is similar to the type except in the following respects: dorsal, 14; ventrals reach nearly to end of anal, inserted midway between base of caudal and posterior edge of pupil, or between end of anal base and middle of opercle. In the ventral, the central three rays are black on the distal half and nearly white proximally. The two outer rays are light dusky for their entire length.

This is a well-marked fish somewhat similar to *C. bahiensis*. Compared with *C. bahiensis*[1] of comparable size, they may be separated according to the following tabulation.

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[1] Based on specimens identified by Breder, 1927, Bull. Bing. Ocean. Coll., I, Art. 1, pp. 22–23.

Cypselurus bahiensis	*Cypselurus smithi*
Caudal lobes both dusky	Upper lobe, whitish, lower black
Dorsal with black blotch	Dorsal posteriorly black
Pectorals all dark	Pectorals with light bar
Ventrals inserted midway between base of caudal and edge of preopercle, or midway between end of anal base and middle of pectoral base	Ventrals inserted midway between base of caudal and eye to pupil, or midway between posterior margin of end of anal base and edge or middle of opercle
Eye, 3.4—3.5	Eye, 3.2

Cypselurus lutkeni Jordan and Evermann

A specimen of *Cypselurus lutkeni* taken by Mr. Clarence R. De Sola off Cayos de Santo Maria, north coast of Cuba, 22° 41′ N., 75° 55′ W., April, 1, 1929,[1] may be described as follows.

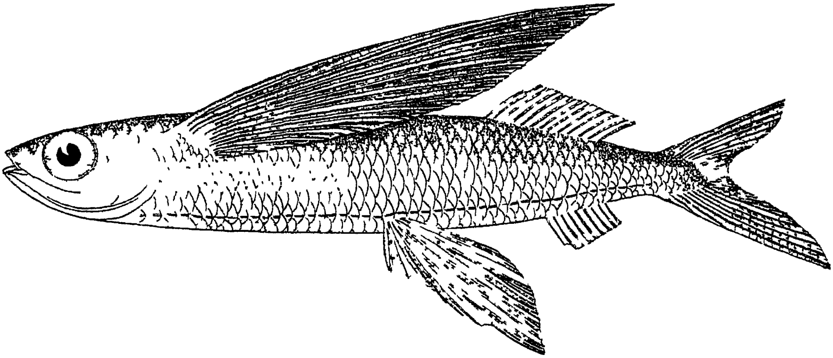

Fig. 4. *Cypselurus lutkeni* Jordan and Evermann. Standard length, 241 mm.

Standard length, 241 mm.; total length, 284 mm. Head in length, 4.2; depth, 5.8. Dorsal, 13; anal, 9. Eye in head, 3.0; snout, 3.5. Lateral line, 50; predorsal scales, 32. Interorbital in head, 3.5; maxillary, 4.8; width of head, 1.9; greatest width of body, 1.8; depth of peduncle, 3.6; lower caudal lobe, 0.8; longest dorsal ray (second), 2.5; anal ray (third), 3.7. Pectoral in length, 1.4; ventral, 3.1.

Body quadrate, head blunt. Ventrals inserted midway between posterior margin of eye and caudal base, and midway between base of last anal ray and insertion of pectoral; dorsal inserted at two-thirds the distance from center of eye to caudal base; anal origin behind dorsal origin a distance equal to snout; a little nearer caudal base than ventral insertion. Pectorals reach nearly to tip of depressed last dorsal ray; ventrals barely to base of last anal ray. Dorsal height, 1.9 in dorsal base which is 1.3 in head; anal height, 1.6 in anal base which is 2.4 in head.

Coloration in Alcohol.—Pectoral rays dusky, except at tips where they are white. Membranes clear, except at their distal third and between first six rays proximally. Ventrals plain, except for first three rays faintly dusky. Caudal uniform dusky. Dorsal slightly dusky; anal plain.

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[1] Flew aboard the molasses freighter S S 'Castana'

This description is not in complete agreement with that of the type, but the differences are such as to be within probable limits of individual variation and expected change with size, as the type was 9 inches (217 mm.) as against 284 mm. in length. There is nothing about this fish, however, that suggests in any way that *lutkeni* is not a perfectly valid species.

This species is certainly close to *C. vitropinna* Breder,[1] but differs distinctly in the following characters.

Cypselurus lutkeni	*Cypselurus vitropinna*
Standard Length, 241 mm.	Standard Length, 172 mm.
Ventral insertion midway between base of caudal and posterior margin of eye and midway between end of anal base and insertion of pectoral	Ventral insertion midway between base of caudal and a point short of the preoperculum and midway between end of anal base and pectoral axil
Lateral line, 50	Lateral line, 46
Predorsal scales, 32	Predorsal scales, 27
Eye, 3.0	Eye, 3.3

It is to be noted that the smaller eye is in the smaller fish. Aside from these differences there are others which, however, would not be conclusive. The pectoral patterns are different, but possibly these change with age. The jaw teeth of *C. vitropinna* are nearly three times as large as those of *lutkeni*.

JAW TEETH OF THE WEST INDIAN *Cypselurus*

Figure 5 illustrates a single tooth from the upper and lower jaw of each species discussed herein. Those forms which are apparently most closely related have the most nearly similar teeth. Thus, teeth of *C. heterurus*, *lutkeni*, and *vitropinna* all have cusps, and the others lack them. If we divide the average of the tooth-lengths by the standard lengths of the fish, we get a rough idea of relative size of teeth, which is very different from one species to another.

U. = Length of average tooth from upper jaw, measured from tip to base, in mm.
L. = Length of average tooth from lower jaw, measured from tip to base, in mm.
S.L. = Standard length of fish (tip of snout to end of last caudal vertebræ in mm.)

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[1] 1927, Bull. Bing. Ocean. Coll., I, Art. 1, p. 21.

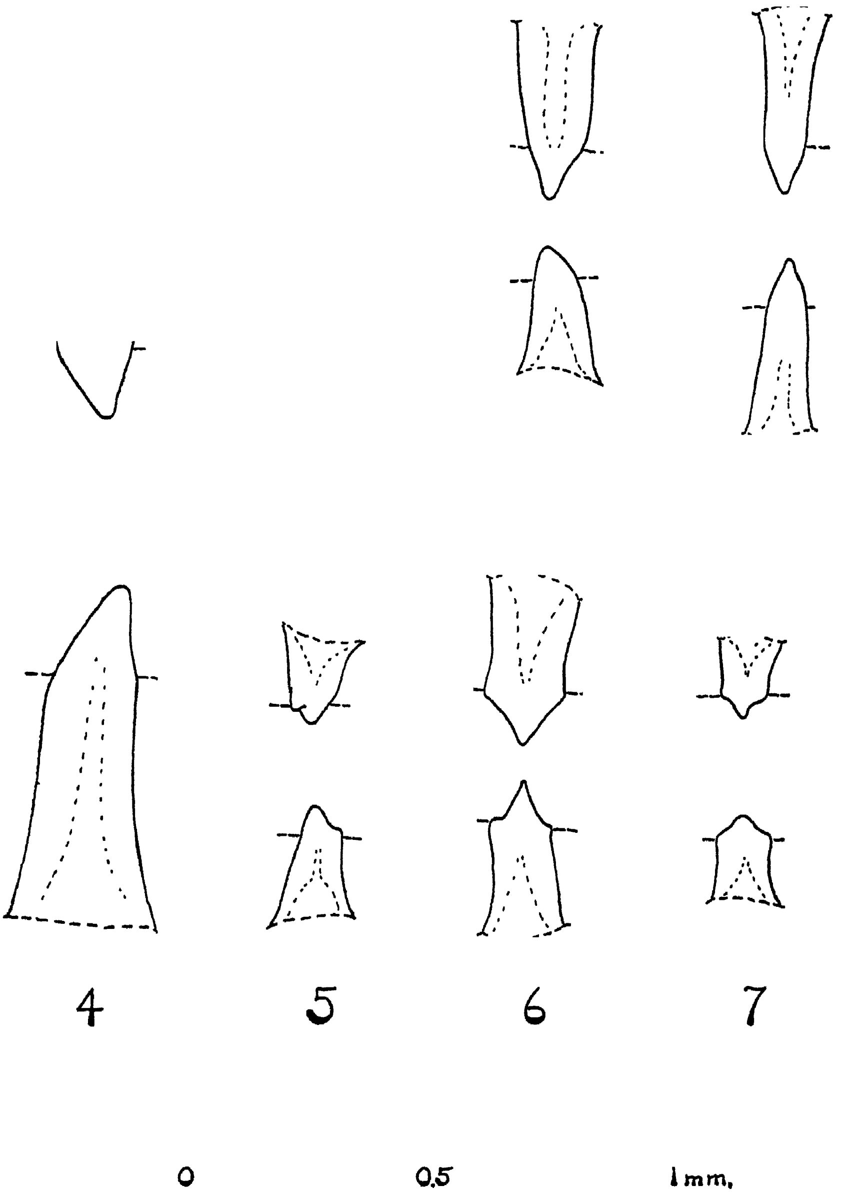

Fig. 5. Upper and lower jaw teeth of *Cypselurus*. Camera-lucida drawings of teeth taken from near symphysis.

1. *C. furcatus*, 150 mm. 2. *C. smithi*, 200 mm. 3. *C. monroei*, 151 mm. 4. *C. bahiensis*, 240 mm. 5. *C. lutkeni*, 241 mm. 6. *C. vitropinna*, 172 mm. 7. *C. heterurus*, 191 mm.

$$\text{Ratio} = \frac{\frac{1}{2}(\text{U.} + \text{L.})}{\text{S. L.}}$$

	U.	L.	S.L.	Ratio
Cypselurus furcatus	.13	.14	150	0.00090
" *monroei*	.34	.32	151	0.00211
" *smithi*	.33	.20	200	0.00132
" *bahiensis*	.61	.57	240	0.00246
" *heterurus*	.15	.14	191	0.00060+
" *vitropinna*	.30	.27	172	0.00165+
" *lutkeni*	.14	.18	241	0.00068

The ratios of these figures serve as another means of separating the species. For example, the teeth of *C. vitropinna* are nearly three times as long as either *lutkeni* or *heterurus*, those of *monroei* twice as long as *furcatus*, and *bahiensis* twice as long as *smithi*. The presence of cusps probably represents a real genetic relationship. It is noted that the pulp cavities also show characteristic variations.

NUMBER OF SPECIES OF *Cypselurus*

That, at this late date, four specimens of the genus *Cypselurus*, collected in a short time in much-frequented West Indian waters, add so much to our knowledge, requires some comment. The four specimens (and one other) may be listed as follows:

Cypselurus smithi	2 specimens	1 new species
Cypselurus lutkeni and *Cypselurus monroei*	2 specimens	2 species known from 1 specimen each
Cypselurus furcatus	1 specimen	1 well-known species

It would appear from this that a greater number of species are frequent in West Indian waters than has been generally supposed. Much of the literature containing keys of these fishes will place under one name what comparative material shows to be more than one form. Thus, the usual paucity of material in the hands of an ichthyologist at any one time, with such keys to work from, has doubtless kept alive the impression that the species of this genus were not numerous, adding to the general confusion concerning their status. It has been the bringing together, and noting the actual differences in a good many specimens from different localities and collections, that has made this condition patent. That it is not a matter of "hair-splitting" is evident from the very considerable and real differences in the present descriptions.

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A JAPANESE WEEVIL, *CALOMYCTERUS SETARIUS* ROELOFS, WHICH MAY BECOME A PEST IN THE UNITED STATES

By Andrew J. Mutchler

During the past summer, Mr. Wayne M. Faunce of this Museum, whose residence is at Colonial Heights in Yonkers, N. Y., brought to me several specimens of a small otiorhynchid weevil. Mr. Faunce's attention was first called to these insects by a neighbor, Mr. E. G. Peters, who had observed them on his grounds. Later, these weevils became so numerous that thousands of them were attracted by the light-colored paint on Mr. Faunce's residence or, in fact to any light-colored object anywhere on his grounds. Their numbers were so great that, even with the windows and doors screened, trouble was experienced in keeping them from entering his residence. Being unable to identify the specimens, we sent them to Mr. L. L. Buchanan of the U. S. National Museum. His reply was as follows:

> The species, *Calomycterus setarius* Roelofs,[1] is highly interesting both from a systematic standpoint and because it is an addition to the North American fauna. It was described by Roelofs from Japan in 1873. In the generic description of *Calomycterus*, Roelofs says that the femora are without teeth, whereas your specimens have a fine, spine-like femoral tooth. However, I have examined a single Japanese specimen of *C. setarius* marked "cotype," which has an identical femoral armature, and I conclude that this tooth was overlooked by Roelofs.

A later communication from Mr. Buchanan in answer to my inquiry about references to the species is as follows:

> I do not know of any reference to the species outside of the original description, so that any observations on its habits and distribution in this country would be of interest. Judging by the success of several other recently introduced oriental beetles in the eastern United States, it seems entirely possible that this weevil may become economically important.

After receiving the above reply, Mr. Faunce made further observations of the beetle and reports that they were found on American and Japanese ivy, rose-bushes, geraniums, woodbine, etc. Considerable damage to woodbine and American ivy occurred, which Mr. Faunce believed was due to these insects, but their feeding on other plants was barely noticeable.

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[1] 1873, Ann. Soc Ent Belgique, XVI, p 175

The following is a description of the specimens found at Colonial Heights, Yonkers, New York. See also figure 1.

Length, 4.5 mm. Black. Legs and antennæ brown. Rostrum short, broad, expanded apically; apex triangularly incised and bare; a fine, more or less obsolete carina begins at the apex of the incision and extends along the median line; scrobes sub-lateral and extending backward from the base of the antennæ in a somewhat straight line so that the upper portion is located approximately at the middle of the front margin of the eye; antennæ with scape slightly curved and reaching a little beyond the apex of prothorax; funicle seven-jointed, first joint slightly longer and stouter than the second, third to seventh joints gradually diminishing in length; club elongate, pointed at apex; scape sparsely covered with short scale-like hairs, funicle sparsely covered with longer hairs. Head covered with a mixture of greenish-gray and brown scales, the paler ones predominating. Eyes moderately prominent, oval, subangulate below; starting at the point of the angle there is a glabrous line which extends underneath the head, becoming somewhat broadened on the ventral portion. Pronotum wider than long, slightly narrower at base than apex; sides

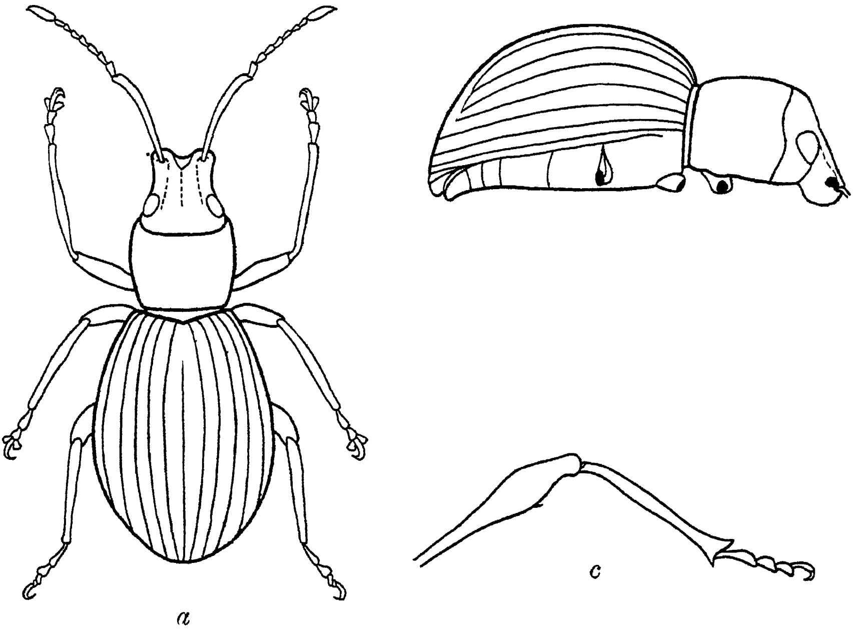

Fig. 1. *a. Calomycterus setarius* Roelofs, dorsal view. *b.* Side view showing ocular lobes and with dotted line to indicate position of antennal groove. *c.* Leg, indicating position of femoral tooth.

approximately parallel, scales as on the head; coarsely punctate; ocular lobes narrow and somewhat long. Elytra broadly convex, broadest slightly behind the basal half, slightly wider than the thorax at base, subacuminate at apex. Each elytron with ten striæ, intervals, near the suture and sides feebly convex, middle ones more strongly convex, the convexity becoming more prominent apically; scales white with greenish and coppery metallic cast; on each interval, from base to apex, there is a row of stiff hairs, each hair proceeding from a puncture; under surface covered with scales and sparse stiff hairs, which are much shorter than those on the upper surface; first and second abdominal segment approximately equal in length, third and fourth together about as long as the second, fifth longer than the fourth, apex rounded. Femora somewhat club-shaped, widest about apical third, gradually tapering toward the base, more suddenly toward the apex. Each femur with an extremely small, narrow, sharp pointed tooth at its widest part. Tibiæ slightly curved at apex, corbels of hind tibiæ open. Tarsi with first joint longer than the second, second and third about equal, third bilobed, claw joint about equal in length to the first, claws somewhat widely open.

This species belongs in the apterous group of the Otiorhynchidæ and, as they do not fly, their spread is apt to be much less rapid than winged forms.

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XI[1]

BY ROBERT CUSHMAN MURPHY

DIOMEDEIDÆ

Thalassarche cauta (Gould)

Many albatrosses belonging to this species were collected during the course of the Whitney Expedition along the east coast of New Zealand, at the Chatham Islands, at Bounty Island, and in the adjacent waters. A study of the entire series, and comparison of the American Museum material with additional examples of the species in the British Museum, the Zoölogical Museum at Tring, the Royal Museum of Science at Stockholm, and other institutions, have led to unexpected conclusions.

In the first place, it appears that at least three races of this albatross, one of them not previously recognized, inhabit the Australasian region. Secondly, two of these three forms evidently become widely dispersed during periods when they are not at the nest, and individuals or groups of each are likely to be found associated at points on the ocean far removed from their respective breeding grounds. Mr. Beck, for instance, shot a typical specimen of *Thalassorche cauta cauta* and an equally typical specimen of *Thalassarche cauta salvini* in lat. 38° S., long. 179° W., one hundred and fifty or more miles east of East Cape, North Island, New Zealand. The nearest known breeding ground to this locality, at the Chatham Islands, is occupied, however, by neither of these subspecies but by a third, which is here described as new.

The circumstances add still further support to my opinion that it is hopeless to undertake taxonomic work with random Tubinares collected at sea. If we had only the pelagic specimens of the Whitney Expedition series we might, indeed, be able to understand *Thalassarche cauta* no better than Loomis (1918, Proc. Calif. Acad. Sci., (4) II, part 2, No. 12, p. 45), who lightly disposed of all the mutant forms by calling them "merely the variations occurring within the bounds of *T. cauta.*" Fortunately, possession of adequate series from the breeding grounds of two races goes far toward bringing an entirely orderly result out of chaos.

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[1] Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, and 370.

To outline the status of the Australasian forms of *Thalassarche cauta*, we may characterize three races as follows:

1.—A large, white-headed and white-naped subspecies, with a light gray tinge on the cheeks in fresh plumage, and a grayish bill. Breeds on islands in Bass Strait, southeastern Australia, and wanders eastward at least to waters east of the Chatham Islands... .. ..*Thalassarche cauta cauta.*

2.—A slightly smaller subspecies (especially in bill and feet), with the head and nape light gray, the pileum distinctly paler; bill grayish. Breeds at Bounty Island, and probably at other subantarctic islands of New Zealand, and wanders eastward across the Pacific to the coast of South America... ......*Thalassarche cauta salvini.*

3.—A short-winged subspecies, otherwise of about the same size as the last, with a dark gray head and nape, the pileum little if any lighter than the remainder; bill entirely bright yellow. Breeds at Pyramid Islet, Chatham Islands; known only from the immediate vicinity of the nesting ground...... *Thalassarche cauta eremita.*

These three types, considered in the same order, are as follows:

Thalassarche cauta cauta (Gould)

Diomedea cauta Gould, 1840, Proc. Zoöl. Soc. Lond., p. 177 (Bass Strait).

One male, lat. 38° S., long. 179° W. (east of East Cape, New Zealand), December 2, 1925; one male, lat. 44° S., long. 173° W. (east of the Chatham Islands), January 29, 1926; older specimens in the American Museum collection from "Australia" and from Kaikoura, New Zealand.

These have been studied in conjunction with other Australian and New Zealand specimens in European museums, including Gould birds which are presumably cotypes, and the type of "*Diomedella cauta rohui*" Mathews, from Botany Bay, New South Wales.

All of the above are similar in appearance, with white heads and napes, matching in every respect Gould's original description. Color notes on the few labels that bear them state that the bills were gray, with the tip of the maxilla horn color, and the feet and legs gray or grayish. Measurements of nine specimens are summarized below, but, in view of the small number of birds and their miscellaneous nature, the figures can hardly be regarded as an adequate statistical record for the subspecies.

Wing, 552–579 (564.8); tail, 190–214 (203.6); culmen, 129–140 (134.1); width of maxilla at base, 31–35 (32.5); depth of closed bill at base, 51–59 (54.7); tarsus, 89–96 (92.4); middle toe with claw, 132–144 (137.2) mm.

Thalassarche cauta salvini (Rothschild)

Thalassogeron salvini ROTHSCHILD, 1893, Bull. Brit. Orn. Club, I, p. lviii (New Zealand).

Nestling young and breeding adults from Bounty Island and the waters roundabout, February 26, 27, 1926; one female, lat. 38° S., long. 179° W. (east of East Cape, New Zealand), December 2, 1925; one female, lat. 44° S., long. 173° W. (east of the Chatham Islands), January 29, 1926.

To these should be added two specimens collected during the Brewster-Sanford South American Expedition, namely, a female, 20 miles west of Cañete, Peru, June 26, 1913, and a female, off Valparaiso, Chile, March 4, 1914. In the British and Tring museums I have examined and measured many other New Zealand, Bounty Island, and Auckland Island specimens, including the type of the race and the bird figured as *salvini*, in Godman's 'Monograph of the Petrels.' Five additional South American examples in the same institutions deserve special citation: a male, near the Ballestas Islands, Pisco Bay, Peru, March 5, 1912; three males and a female, off Lobos de Tierra Island, northern Peru, May 28, June 20, 26, and 27, 1912. One of the last is a young male in the plumage that has been described as characteristic of *Thalassarche layardi*. I shall revert to this matter.

The characteristic features of *T. cauta salvini* are the gray head, combined with a gray bill similar to that of typical *cauta*. The hue of the head and nape in fresh plumage varies between pale neutral gray and deep gull gray, lighter on the crown and sometimes whitish on the throat. As wear progresses, all of these parts become lighter, because the bases of the feathers are white, but the head of *salvini* never has the sleek creamy white surface, with a pale gull gray tinge on the cheeks, which is characteristic of the typical race in high plumage.

Notations on the labels of our Bounty Island specimens, together with a water color drawing of a nesting adult by Mr. Correia, show that the bills were bluish or greenish gray, with a horny or "ivory" culmen, and a blackish terminal spot on the mandible. The transverse fleshy stripe at the base of the mandible was orange. The legs and feet are recorded as bluish or bluish gray. The same notes on flesh colors are found on the labels of our specimens from the west coast of South America, which, in appearance and dimensions are indistinguishable from topotypes.

The following summary of measurements is based upon typical adults from all of the localities named above.

Thirty-two males and females: wing, 523–585 (556); tail, 188–220 (205); exposed culmen, 117–135 (128); width of maxilla at base, 27–33 (30); depth of closed bill at base, 46–56 (51.6); tarsus, 80–95 (88.1); middle toe with claw, 121–139 (131.3) mm.

The range of bill size is notably smaller than in *T. cauta cauta.* Sexual dimorphism is almost negligible, as shown by the following comparison based upon 16 breeding adults of *T. cauta salvini* from Bounty Island and the neighboring waters.

	WING	TAIL	CULMEN	TARSUS	TOE
10 ♂	548-585 (562)	204-216 (210)	128-134 (131)	85-95 (90.1)	134-137 (135)
6 ♀	547-577 (560)	201-220 (210)	124-130 (128)	82-93 (87)	125-137 (130.8)

Well-grown chicks are represented among our Bounty Island birds. These were moulting from a light neutral gray down into a plumage exactly like that of their parents. Their bills were blackish in the younger stages, graying as they approached full size. The feet were light bluish, sometimes almost white.

As noted above, certain specimens of *T. cauta salvini* not only closely match the description of the *Thalassogeron layardi* of Salvin (1896, 'Cat. Birds Brit. Mus.,' XXV, p. 450, Cape of Good Hope seas), but also resemble the type skin of that form. This resemblance seems to be the result of fading, no less than wear, of the gray head-feathering. Salvin's measurements for *layardi* fall within the range of those of *salvini.* It would seem as though the former, if it really exists as a subspecies, had not yet been properly characterized. Neither would it be surprising if *T. cauta salvini* extends its range westward across the Indian Ocean as it does eastward across the Pacific. Possibly the type of *layardi* is merely a bleached specimen of *salvini,* the counterparts of which are not uncommon among pelagic wanderers taken in the Pacific. On the other hand, it is possible that a representative of the species *cauta* breeds in the vicinity of the Cape of Good Hope. In the Tring Museum there are two undated birds of unknown sex labeled, respectively, Robben Island and Dyer's Island, South Africa.

Thalassarche cauta eremita, new subspecies

SUBSPECIFIC CHARACTERS.—Differs from *Thalassarche cauta salvini* in that the coloring of the head and nape is more uniform, and much darker (deep neutral gray to deep mouse gray instead of light neutral gray), the bill entirely yellow, the size slightly smaller, particularly in length of wing.

TYPE.—No. 211,438, Amer. Mus. Nat. Hist.; male adult, nesting; Pyramid Rock, off Pitt Island, Chatham Islands; March 2, 1926; R. H. Beck.

MEASUREMENTS.—(7 males, 9 females): wing, 534–562 (546); tail, 203–218 (209); exposed culmen, 117–130 (125.7); width of maxilla at base, 28–33 (30.1); depth of closed bill at base, 49–54 (51.4); tarsus, 82–90 (86.2); middle toe with claw, 122–137 (128) mm.

RANGE.—Known only from Pyramid Rock and the waters immediately adjacent.

Adults, mostly with enlarged gonads, from Pyramid Rock and vicinity, March 2 and 3, 1926.

The Pyramid, or Tarakoikoia Islet, is the southernmost of the Chathams. It is an islet 566 feet in altitude, lying about four and a half miles south-southeast of Pitt Island. Other islets in the Chatham group were found to be occupied by albatrosses of other species. So far as known, Pyramid Rock is the only breeding ground of *Thalassarche cauta eremita*. As related heretofore, examples of the species *cauta* collected on the high sea about the Chatham Islands belong to the other two subspecies, not to *eremita*. The series from Pyramid Rock is, however, entirely uniform.

In size the sexes are practically alike, males showing a very slight superiority, as in *T. cauta salvini*.

Flesh colors recorded on the labels give the bill merely as "yellow," the feet as "whitish" or "bluish-white." In the dried skins the bills are clear straw yellow, with a dark horny spot on the nail of the mandible. They are thus very different in appearance from the bills of the two races considered above. Fortunately, Mr. Correia's notes include a beautiful, life-size water color sketch of the head of a breeding female. Comparing this with the plates of Ridgway's 'Color Standards,' we may describe the bill of the living bird as follows: entire culmen, light cadmium; latericorn, deep chrome, slightly lighter basally; mandible, deep chrome, with the ramus lighter and the distal plate terminating in a dusky spot; transverse line at base of mandible, cadmium orange, a color continued along the gape of the mouth; narrow skin between plates of bill and feathering, and also that extending to the nostril between the culminicorn and the latericorn, black.

Aside from bill color, the dark gray head of *eremita*, with only slight variation on either forehead or throat, presents an aspect very unlike those of the subspecies *cauta* and *salvini*. The black loral-ocular streak is inconspicuous in *eremita* because it divides regions of practically the same tone instead of separating gray lores from a whitish crown.

The fact that *eremita* is a short-winged race, apparently confined to a single small breeding area, and overlooked during so many decades of marine collecting, might lead to the interesting speculation that it is also a highly sedentary subspecies, in sharp contrast with its closest relatives. It is equally possible, however, that the lack of previous recognition is due rather to its small numbers, which would proportionately reduce the chances of capturing specimens at a distance from the nesting area. So far as we know, the entire population of the race comprises only a few hundred birds. Perhaps the present diagnosis may lead to the recognition of other specimens in collections, which may have been identified as *salvini*, and thus extend our knowledge of an extraordinarily interesting discovery.

Thalassarche bulleri (Rothschild)

Diomedea bulleri Rothschild, 1893, Bull. Brit. Orn. Club, I, p. lviii (New Zealand).

Diomedea platei Reichenow, 1898, Ornith. Monatsber., VI, p. 190 (Cavancha, Chile).

Diomedella cauta Platei, Dabbene, 1926, El Hornero, III, p. 324 (part).

Specimens from Forty-Fours Islets and Round Rock, Chatham Islands, and the adjacent waters, March 6, 8, and 16, 1926; one female, lat. 35° S., long. 175° W. (northeast of North Island, New Zealand), December 9, 1928.

In the Brewster-Sanford South American series are a male and a female taken twenty miles west of Cañete, Peru, June 26, 1913, and a male from Valparaiso, Chile, March 9, 1914. Many additional skins from the New Zealand region (Dunedin, Otago Head, Snares Island, etc.), including the type of the species, and also the type specimen of "*Diomedea platei*" from the coast of Chile, have been studied in the museums at London, Tring, Berlin, and Frankfort.

Diomedea platei has hitherto been synonymized with *Thalassarche cauta*. It proves, however, to be a young example of *bulleri*, entirely comparable with specimens of like age in the American Museum. The bill of the type specimen shows all the peculiarities of the species. An obsolescent mandibular sulcus is well marked. The head is suffused with buffy gray, as in other juvenals, but the forehead is already whiter than the crown. The body plumage is quite fresh; I should judge that the bird had not been many weeks out of the nest.

The *Thalassogeron desolationis* of Salvadori (1911, Bull. Mus. Zoöl. Anat. Torino, XXVI, No. 638, p. 2), from the Pacific entrance of the Strait of Magellan, I am unable to identify from the published description. The recorded length of the culmen (114 mm.) seems too small for any form of *cauta*, while the dimensions of wing and tarsus are too great for *bulleri*.

Forty-Fours Islets, where the bulk of our series was collected, lie nearly on the parallel of 44° S., about twenty-two miles from the southeast point of Chatham Island. Round Rock is off the south point of Pitt Island.

Most of the Chatham Island birds were undergoing moult and replacement of the quills. Descriptions of the flesh colors are again supplemented by paintings of freshly killed specimens from the brush of Mr. Correia. Bill, black on the latericorn and upper half of mandible; culminicorn, nail, and ramal portion of the mandible, bright yellow; transverse stripe at base of mandible, orange. Feet and legs, light blue, richest among breeding birds. Although the feet were always bluish in life, their dark color in the dried skins explains why Godman records them as red.

Males average very slightly, if at all, larger than females. The following summary of dimensions is based upon twenty-nine specimens from all of the localities named above, and almost equally divided as to sex.

Wing, 462–526 (500); tail, 175–199 (188.6); exposed culmen, 115–126 (120); width of maxilla at base, 26–30; depth of closed bill at base, 42.5–49; tarsus, 78–85 (81.1); middle toe with claw, 110–124 (117.2) mm.

Mr. Beck records that a male from Forty-Fours Islet weighed eight pounds in the flesh, and had a wing-spread of six feet ten inches.

In my opinion, it is impracticable to attempt generic subdivision among the smaller albatrosses of the group to which both *bulleri* and *cauta* belong. There is wide latitude in the precise arrangements of the plates of the bill, even among individuals of the same species. In general, the dorsal aspect of the bill of *bulleri* resembles that of *melanophris*. The culminicorn and latericorn are practically in contact behind the nostril, and the basal width of the latericorn does not exceed 20 mm.

In *cauta* the membrane between culminicorn and latericorn varies in distinctness, but there is always such a membranous space between the base of the culmen and the feathering of the forehead. The width of the latericorn at its base, exceeding 25 mm., will serve to distinguish the species from *bulleri* or *chrysostoma*.

PROCELLARIIDÆ

Puffinus griseus (Gmelin)

Procellaria grisea Gmelin, 1789, 'Syst. Nat.,' I, part 2, p. 564 ("Southern Hemisphere, from latitudes 35°–50°" = New Zealand seas).

Nectris chilensis Bonaparte, 1856, 'Consp. Av.,' II, p. 202.

Puffinus Stricklandi Ridgway, 1884, in Baird, Brewer, and Ridgway's, 'Water Birds North America,' II, p. 390.

Puffinus griseus, Loomis, 1918, Proc. Calif. Acad. Sci., (4) II, part 2, No. 12, p. 132

Puffinus griseus chilensis, Dabbene, 1923, El Hornero, III, p. 9, Fig. on p. 25.

Specimens from Mokohinou Islets, east coast of North Island, New Zealand, January 13, 1926 (nesting adults): adults and half-grown downy young, Rabbit Islet, Chatham Islands, March 6, 1926; numerous adults taken at sea between New Zealand, the Chathams, and Bounty Island, (lat. 37°–50° S., long. 175° E.–173° W.), November 30, 1925 to March 2, 1926.

The chicks referred to are covered with deep Quaker drab down, much longer and of looser texture on the dorsal surface than below.

In addition to the Whitney Expedition specimens, the American Museum possesses other New Zealand examples, as well as one labeled "Samoa, 1911." The latter formed part of a considerable collection of Samoan birds presented by the Hon. Mason Mitchell. In general, however, this shearwater seems to avoid the central parts of the Pacific and Atlantic Oceans, and to confine its range rather to the peripheries.

In fixing the type locality of *P. griseus* in the New Zealand region, I follow Mathews (1912, 'Birds Austral.,' II, p. 95), who states that the type specimen of Latham's description, upon which Gmelin based his name, came from 40° S., in the Pacific Ocean, near New Zealand.

Although seven or more specific names have been applied to this shearwater, it seems clear that all Pacific and Atlantic specimens are indistinguishable from the New Zealand form. The American Museum has large series from both oceans in both the northern and the southern hemispheres. I have compared these, and have also prepared tables of measurements based upon birds from each comprehensive locality. The figures agree well with those of Loomis (1918, p. 137), which cover 165 specimens from the coast of California. In other words, the world-wide individual variation proves to be approximately the same as the individual variation of a fully representative series from a single locality.

The figures given below include measurements of both sexes, and are drawn from the New Zealand birds already listed, and from other American Museum specimens bearing the following data:

Pacific Coast of America.—Queen Charlotte Islands, June, August; Washington, June, August; California (many localities). May to November; Lower California, including the Gulf, July; west coast of Mexico, September; Panama, June; Ecuador, July; Peru (many localities), April to June, November; Chile (many localities), January to March, September, December (nesting at Wollaston Island, January, 1915).

ATLANTIC COAST OF AMERICA.—Patagonia (48°–57° S. lat.), September; northern Argentina, October; east coast of Florida, June; Gulf coast of Florida, July; Cape Hatteras, June; Long Island, N. Y., June; Massachussetts, May, August; Nova Scotia, June; Labrador, August; Grand Banks, August.

Forty males and females: wing, 280–309 (293); tail, 84–99.2 (89.4); exposed culmen, 38–45.6 (41.7); tarsus, 52.5–59.5 (55.4); middle toe with claw, 50.9–71.5 (63.1) mm.

These figures should be compared with those of Loomis, who has segregated the males and females. The sexes appear to be alike in size, and Loomis's own data do not warrant his statement that the majority of females are smaller than males.

Flesh colors, according to the labels of New Zealand and South American specimens are: bill, blackish, but sometimes horn-color on the mandible; legs and feet externally blackish, but blue or purplish on the webs, inner toes, and inner side of tarsus.

Puffinus tenuirostris (Temminck)

Procellaria tenuirostris TEMMINCK, "1838," (=1835), 'Nouv. Recueil de Planches Color. d'Ois.,' V, livraison 99, text facing Pl. 587 (seas north of Japan, and the coast of Korea).

Puffinus tenuirostris tenuirostris HARTERT 1920, 'Vög. Paläarkt. Fauna,' II, p. 1427.

Two males, lat. 37°–38° S., long. 179° W., December 1, 1925.

The locality is east of North Island, New Zealand. One specimen had just completed the moult of the wing quills, and the very short new remiges are enclosed in the sheaths. The wing length of this example is only 256 mm.

The two Whitney Expedition specimens represent different plumage phases, one having a whitish throat and wing lining, the other being dark. The bills of both were "blackish," the legs and feet "purplish," with the outer toe and outer side of tarsus black. The testes of both were small.

There is nothing in appearance or dimensions to distinguish them from other examples of the species taken at widely separated points in the Pacific. The measurements below are based upon eight specimens in the American Museum collection, the wing length of the moulting Whitney Expedition bird being omitted. Additional localities represented are as follows: Anadyr, northeastern Siberia; seventy-five miles west of St. Paul Island, Alaska; Akutan Island, Alaska; Tuamotu Archipelago, South Pacific; "Philip Island, New Zealand." The last may refer to the Philip Islet at Norfolk Island or to Phillip Island, Victoria, Australia, a known breeding ground.

Eight specimens, 6 of which are males: wing, 263–277 (272); tail, 76.9–85.8 (80.9); exposed culmen, 32.2–34 (33); tarsus, 49.4–52.9 (50.9); middle toe with claw, 57.5–62.2 (59.6) mm.

The figures agree well with those presented by Loomis (1918, p. 140) and by Hartert. In view of Loomis's study of fifty-five specimens taken off Point Pinos, California, it would seem that dichromatic variation and intermediate plumage stages are sufficient to include all the described races of this species. So far as I know, the bird has not been found nesting in the northern hemisphere. The alleged subspecies, *brevicaudus*, apparently needs further support than has yet been advanced.

Both the form and the shortness of the bill are apparently sufficient to distinguish *Puffinus tenuirostris* with certainty from *P. griseus*.

Puffinus carneipes Gould

Puffinus carneipes Gould, 1844, Ann. and Mag. Nat. Hist., p. 365 (small islands off Cape Leeuwin, western Australia).

Specimens from the Gulf of Hauraki, Mokohinou Islets, Hen and Chickens (Moro Tiri) Islets, New Zealand, January 12–14, 1926; at sea, east of North Island, New Zealand (lat. 35°–38° S., long 170°–180° W.), November 30–December 10, 1925; east of the Chatham Islands (lat. 42°–44° S., long. 173°–175° W.), January 25–29, 1926; also two older specimens, one a fledgling with down still clinging to its plumage, from Lord Howe Island.

The birds collected at sea during November and December, 1925, were mostly in breeding condition. The other Whitney Expedition specimens had small gonads.

The Lord Howe Island specimens are comparable in every way with those in the New Zealand series. The same is true of California birds, as indicated by Loomis's figures (1918, p. 132). The several subspecific names used by Mathews and Iredale (1921, 'Man. Birds Austral.,' I, p. 29) have apparently never been correlated with actual conditions in nature.

The first example of *Puffinus carneipes* to be recorded from the eastern South Pacific is a male collected by R. H. Beck eight miles off Masatierra Island, Juan Fernandez, Chile, February 9, 1914, during the course of the Brewster-Sanford South American Expedition. This specimen is an adult with worn body plumage but recently renewed wing and tail quills. The testes were small, and the claws elongated and sharply pointed as is usual in petrels that have been long away from their nesting grounds. It matches New Zealand specimens in both appearance and proportions, except for the long claws. Its measurements are as follows: wing, 324; tail, 108.7; exposed culmen, 43.8; tarsus, 55.5; middle toe with claw, 70 mm.

Below are the summarized measurements of twelve specimens from the New Zealand region, including Lord Howe Island. They may be compared with Loomis's table, for I have found by tests upon identical specimens that the late Mr. Loomis and I arrive at approximately the same result with our respective calipers. In fact, the only noticeable difference in our method appears in tables for length of tarsus, in which Loomis's figures are usually slightly smaller than my own.

Six males, 6 females: wing, 317–329 (321.2); tail, 109–115.1 (113.2); exposed culmen, 37.6–43.3 (41); tarsus, 51.6–56.3 (54.2); middle toe with claw, 62.7–67 (65) mm.

The sexes are alike in size. Bill, flesh color, with the tip and the anterior part of the culmen black; feet and legs, flesh color, the tarsus and outer toe externally brown.

Puffinus leucomelas (Temminck)

Procellaria leucomelas Temminck, "1838," (=1835), 'Nouv. Recueil de Planches Color. d'Ois.,' V, livraison 99, Pl. 587 and text referring thereto (seas of Japan).

One male collected in lat. 3° 10′ S., long, 155° E. (near the Abgarris Islands, Bismarck Archipelago), January 4, 1928.

The specimen is marked as an immature bird, though it had attained full growth. Bill, "light gray and bluish horn color"; feet and legs, pale pinkish, with the outer toe and outer side of tarsus brownish. It agrees in every respect with specimens examined in the Berlin and Frankfort museums.

The following measurements include the Whitney Expedition bird and seven others labeled, respectively, "Japan," Sagami Sea, Uraga Channel, "New Guinea" (3), and Menado, Celebes Islands:

Wing, 300–326 (315); tail, 130–140.5 (135.2); exposed culmen, 48–52.5 (50.4); tarsus, 48–52 (49.8); middle toe with claw, 59–67 (63.2) mm.

P. leucomelas is the type of the subgenus *Calonectris*, the reputed characters of which are somewhat vulnerable. However, it seems to be a member of a small but natural, and nearly cosmopolitan, group of shearwaters, which includes *P. creatopus* and *P. diomedea* (*kuhlii*). Aside from its distinctive plumage, especially the streaked head, *P. leucomelas* differs from the other members in its relatively elongate bill and tail as compared with the lengths of tarsus and wing. In *P. crea-*

topus the bill is decidedly shorter than the tarsus; among all subspecies of *P. diomedea* the difference is less, though still in favor of the tarsus; in *P. leucomelos* these structures are subequal, the average length of the tarsus being slightly less than that of the culmen.

The two Pacific species, *P. leucomelas* and *P. creatopus*, show no evidence of sexual dimorphism. In *P. diomedea*, on the other hand, judging by measurements of good series of Atlantic and Mediterranean races (*diomedea*, *borealis*, and *edwardsi*), males average considerably larger than females.

Puffinus gavia (Forster)

Procellaria gavia FORSTER, 1844, 'Descr. Anim.,' edit. Lichtenstein, p. 148 (Queen Charlotte's Sound, Cook Strait, New Zealand).

Specimens from New Zealand and the adjacent waters. Adults and downy young, Channel and Great Barrier Islands, January 18, April 21–23; adults, Gulf of Hauraki, January 12; Hen and Chickens Islets, January 14; off Lyttleton, January 28, 1926; lat. 38° S., long. 178°–179° W., December 4, 1925; lat. 44° S., long. 173° W. (east of the Chatham Islands), January 26, 29, 1926.

The chicks referred to are well grown, some completely covered with gray down, others with the contour plumage of dorsal surface, throat, and breast, exposed. Many of the adults taken at sea during December and January had enlarged gonads. Bill, blackish; feet and legs, flesh color, with the outer side of the toe and tarsus blackish.

The specimens exhibit a wide range of variation in the pigmentation of the ventral surface. A few are almost entirely white, whereas others have dark areas that extend as a heavy flecking across the base of the neck, and forward well toward the chin.

Great extremes in the degree of wear are also shown by birds collected during the same month; thus, a female taken east of the Chathams on January 29 is in fresh and glossy plumage, while another taken at Channel Island on January 18 is excessively worn and frayed both as to quills and body plumage.

The sexes are alike in size. Measurements from the series give the following figures:

Ten males, 5 females: wing, 206–224 (213.6); tail, 57.7–68.1 (62); exposed culmen, 34.2–37.4 (35.4); tarsus, 40.3–46.4 (43.2); middle toe with claw, 45–50.1 (47.6) mm.

Puffinus opisthomelas Coues, of the California coast, is clearly an eastern Pacific and northern hemisphere representative of *P. gavia*.

Although *opisthomelas* is of larger size, the proportions of the two species are identical. Moreover, they reveal a dual coloration of the same type (cf. Loomis, 1918, pp. 114–119, Pl. XIV). The under tail coverts of *gavia* appear to be uniformly white; those of *opisthomelas* are usually dark. However, Loomis reports that in some instances "white nearly supplants the dark color on the shorter lower tail-coverts." If there should prove to be an actual intergradation in this character, I should suppose that *opisthomelas* would have to be regarded as a subspecies of *gavia*.

Measurements of fifteen specimens of *P opisthomelas* from the coasts of California and Lower California are as follows:

Wing, 233–245 (240); tail, 70.6–81.8 (76.1); exposed culmen, 35.4–38.5 (37.3); tarsus, 44.1–48.3 (46.2); middle toe with claw, 50–54.4 (52.4) mm.

Puffinus heinrothi Reichenow

Puffinus sp.? HEINROTH, 1902, Journ. fur Ornith., p. 397.

Puffinus heinrothi REICHENOW, 1919, Journ. fur Ornith., p. 225 (Blanche Bay, New Britain).

From the Territory of New Guinea Museum Mr. Beck obtained a specimen of this interesting shearwater in exchange for other material. The American Museum also possesses two others, received through the courtesy of the Zoölogical Museum of Berlin, in which institution I have, moreover, examined the type. The few known examples all came from the northeasterly tip of New Britain. Our three are labeled Uatom Island, which lies just westward of the port of Rabaul. One of them appears to be a fledgling, and it is doubtful whether a second is fully adult.

Save for a whitish median area on the belly, and an admixture of white in the wing lining and on the chin and throat, this is an all sooty bird. The general color tone is brown and warm, not blackish or "bluish" as in the races of *Puffinus assimilis*. It is a very distinct species from any other known petrel, its most marked character, perhaps, being the exceedingly long and slender bill. In the following measurements of four specimens of unknown sex, the short wing and tail lengths of one fledgling are not included:

Wing, 185–198 (190.7); tail, 75.3–84 (79.5); exposed culmen, 29.8–32.3 (30.9); least depth of closed bill, 4.7–4.8; tarsus, 35–39.5 (36.4); middle toe with claw, 37.9–44.7 (41.3) mm.

The proportions and plumage characters indicate that *Puffinus heinrothi* may have its closest affinities with the *lherminieri* group (cf.

Murphy, 1927, Amer. Mus. Novit., No. 276, table on p. 15). It is clearly not related to *P. tenuirostris* or *P. nativitatis*, as suggested by Dr. Reichenow.

Thyellodroma bulleri (Salvin)

Puffinus bulleri SALVIN, 1888, Ibis, p. 354 (New Zealand).

Specimens from Poor Knights Islets, North Island, New Zealand, January 16, 1926 (nesting); Gulf of Hauraki and Mokohinou Islets, January 12, 13, 1926; at sea, east of New Zealand and near the Chatham Islands (lat. 35°–44° S., long. 173°–180° W.), November 30–December 10, 1925.

Our excellent series from New Zealand has been compared with California specimens, and with others obtained off Valparaiso, Chile, between February 24 and March 13, 1914. I have also measured a Chilean series in the Berlin Museum. All these birds represent one form, as Loomis and others have already concluded. The following measurements agree substantially with those of Loomis (1918, p. 150), the only noteworthy difference being in the range of length of tarsus:

Twenty-four males and females from New Zealand, Chile, and California: wing, 275–300 (287.3); tail, 114–131.8 (125.3); exposed culmen, 39–44.6 (41.8); tarsus, 49–53.5 (51.5); middle toe with claw, 58.5–65 (61.5) mm.

Most of the South American examples taken during February and March were moulting their quills and had resting gonads. The New Zealand birds, on the other hand, were all believed by the collector, Mr. Beck, to be in the midst of their breeding period, and several were actually taken on their eggs during January.

Bill, blue or bluish, the tip and culmen, black; feet and legs inwardly flesh color, including the two inner toes and the webs; outer toe and outer side of tarsus, blackish. The blue of the bill may represent a heightening of color characteristic of the breeding season, for many non-breeding specimens are marked as having "grayish" beaks.

Pterodroma leucoptera longirostris (Stejneger)

Æstrelata longirostris STEJNEGER, 1893, Proc. U. S. Nat. Mus., XVI, p. 618 (Hondo, Japan).

"*Æstrelata longirostris*," MURPHY, 1929, Amer. Mus. Novit., No. 370, p. 15.

Pterodroma longirostris, HARTERT, 1920, 'Vög. Paläarkt. Fauna,' II, p. 1431.

Six specimens referable to this form were taken during the Crane Pacific Expedition on August 17, 1929, in lat. 39° 22′ N., long. 148° 46′ E., North Pacific Ocean. The locality is about six hundred miles east of the northern end of Honshu, Japan. Five of the skins have been kindly lent by the authorities of the Field Museum of Natural History, Chicago, and have been compared with the other races of *Pterodroma leucoptera* considered in my recent review of the group.

Stejneger's notes on the characteristics of this form are not all diagnostic because the subspecies of both *Pterodroma leucoptera* and *Pterodroma cookii* have proved more complex than was realized in 1893. However, *longirostris* differs in appearance from typical *leucoptera* and from *masafueræ* in that the gray or blackish patch at the sides of the breast is much reduced in extent. The inner webs of the tail quills, moreover, are prevailingly darker in *longirostris* than in the forms named. From *Pterodroma leucoptera hypoleuca*, which *longirostris* generally resembles, it differs in that the primaries are largely white on their inner vanes. The last is an excellent and constant character; the two races *hypoleuca* and *brevipes* have solidly dark wing quills, while all other subspecies of *leucoptera* show the white wedges.

Dimensions of the Crane Expedition specimens, of which two were males and three females, agree closely with Stejneger's measurements of the two previously known examples. All five of the new birds, as well as the type and cotype, were moulting the quills when captured, the outer primaries of the Crane skins still bearing the sheaths. The range of wing and tail lengths may, therefore, be abnormally low.

Five specimens (2 males, 3 females): wing, 201–210 (203.8); tail, 90.5–101.6 (96.5); exposed culmen, 23.6–25.4 (24.7); tarsus, 27.7–31.4 (28.9); middle toe with claw, 32.2–37.6 (36.3) mm.

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AN ANALYSIS BY MOVIETONE OF A CRICKET'S CHIRP (*GRYLLUS ASSIMILIS*)

BY FRANK E. LUTZ AND W. R. HICKS

Male crickets make a trilling, chirping sound by rubbing their front wings together. The under side of a strong transverse rib ("vein") near the basal end of each front wing bears a series of elevations forming the "file," figures 1 and 2. When the wings are rubbed from side to side this file scrapes on a slightly elevated spot on the upper side of the other front wing, setting the wings into up and down vibration. Since one wing, usually the right one,[1] is kept above the other, its file is the only functional one. A large, somewhat circular area near the distal end of each front wing suggests a drum-head and is supposed to increase the efficiency of the wing as a sound-producing organ.

If the wing be merely set into vibration, as when the head of a drum is struck, or a bow is drawn across a violin string, the pitch of the sound would depend on the natural periods of vibration of the wing as a whole and also of the complicated system of thin membranes and heavy veins which make up the wing (Fig. 1). However, the wing is attached at only a small basal part and is so soft that such vibrations of the wing as a whole would be quickly damped by air resistance. On the other hand, if each tooth of the file as it strikes the scraped surface makes the wings wave up and down once, causing an air-wave, a rapid succession of such waves would cause a sound independently of any natural period of vibration of the wing structures, although the two sounds might be combined to make up the chirp.

Kreidl and Regan (1905, Sitzungsberichte der Math.-Naturwiss. Klasse der K. Acad. der Wissenshaften, Wien, CXIV, pp. 57–81) carefully studied the chirp of a European cricket (*Gryllus campestris*). They found that the "file" had about 135 teeth, each about 0.14×0.04 mm. These rub on a raised surface about 1.5 mm. in diameter. By putting grease on the file and then noting where it was left after chirping they found that all of the teeth except a few small ones at the end were used. By putting a white dot on a wing and interrupting a beam of light so

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[1] Lutz, F. E., 1908, American Naturalist, XLII, p. 196.

Fig. 1. Under side of the dorsal part of the right front wing of a male cricket, the lateral part removed The "file" is on the lower of two heavy cross-veins shown near the top of the figure.

that the dot appeared to stand still while the cricket was chirping, they concluded that there are six to eight complete (back and forth) strokes of each wing per second. This means that the wings go one way or another 12 to 16 times per second but, since while one is going right the other is going left, the approximately 131 teeth are rubbed at the rate of 131×24 to 32, making 3144 to 4192, teeth per second. The authors recorded the sound on a phonograph (presumably a wax cylinder) and counted the marks. From this record they calculated that the chirps are made by from 3157 to 4234 air vibrations per second, these figures agreeing well with the other calculation. They note that this pitch, which is near to the upper range of a piano, varies from one individual to another and also with the same individual, a statement which is doubtless true but the proof of which would depend upon the doubtful accuracy of the phonograph's speed.

Fig. 2. Anterior (outer) portion of the "file," It may be oriented with respect to figure 1 by the four small cells shown below it in each figure.

In recent years a new method of recording and reproducing sound has been devised.[1] As utilized by the Fox Film Corporation for newsreel and studio production it is known as the Movietone System. It consists essentially of a microphone, which transforms sound-waves into electrical energy, and amplifiers to increase the comparatively feeble microphone currents to values sufficient to cause a glow tube to flicker in exact correspondence with the frequency and intensity of the sound. This glow tube (called aeolight because of the alkali earth oxide used in one of its electrodes) is placed in the camera so as to affect a narrow track beside the picture strip of a "movie" film. This exposure is made through a quartz plate having a silver-plated coating in which there is a slit 0.0008″×0.12″. The emulsion side of the film passes over and close to the slit, back of which is the aeolight.

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[1] The Western Electric Company apparatus.

Since the lag of the aeolight is exceedingly small and since the speed at which the film passes the slit is very accurately controlled by an induction motor, this method of sound recording is excellent for frequencies within the normal audible range. For the recording of very shrill sounds at or beyond upper range of the human ear the film would have to be run faster than the usual ninety feet per minute and the aeolight burned more brightly to compensate for the decreased time of exposure. Other practical limitations, such as slit construction and adjustment, film emulsion characteristics, and so on, combine to fix a maximum of about 8000 cycles for practical sound recording by this method. Knowing the speed of the film, one has only to count the number of lines on this sound-track and do a simple calculation to determine the pitch of the sound. In this work the negative should be used to obviate the possibility of inaccuracy introduced by printing and processing. Film shrinkage is too slight to introduce a practical error. Since the greater the volume of the sound the greater the aeolight fluctuation, the density contrast in the photographic record becomes a measure of the volume of the sound, but it can be safely used only as an approximation to a relative measure and not exactly.

Since the apparatus will not practically record more than about 8000 cycles per second, it will not show possible harmonics generated in conjunction with fundamental sound vibrations in the neighborhood of 4000 cycles. Consequently, any harmonics which may be present in a cricket's chirp would be missed.

The cricket whose chirp was to be recorded was put into a small cage fitted with a front of high-quality optical glass to enable taking the picture part of the movietone. Illumination, when desired, was obtained from Cooper-Hewitt tubes and incandescent lamps fitted with reflectors. It was found that a sudden turning on of the lights did not cause the cricket to stop its chirping or even to change its position. Accordingly, to avoid as much as possible the heating effect of the lamps, they were kept on only when the recording apparatus was running.

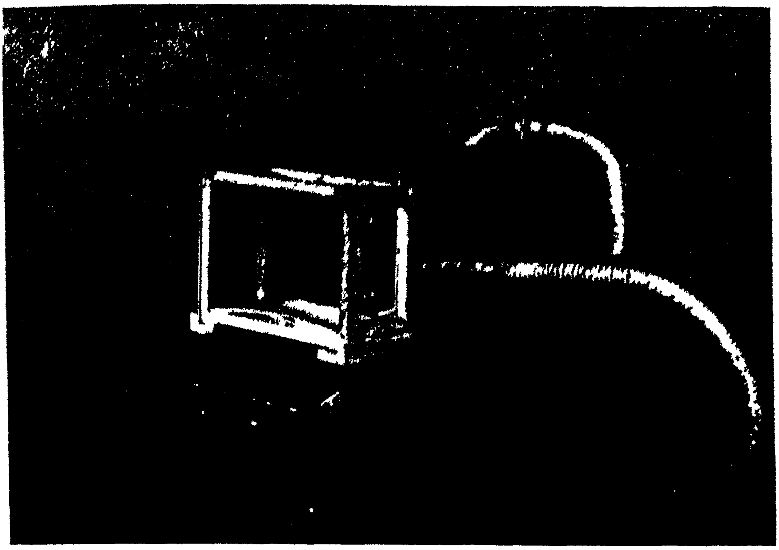

Fig. 3. Cage and microphone inside the sound-proof booth

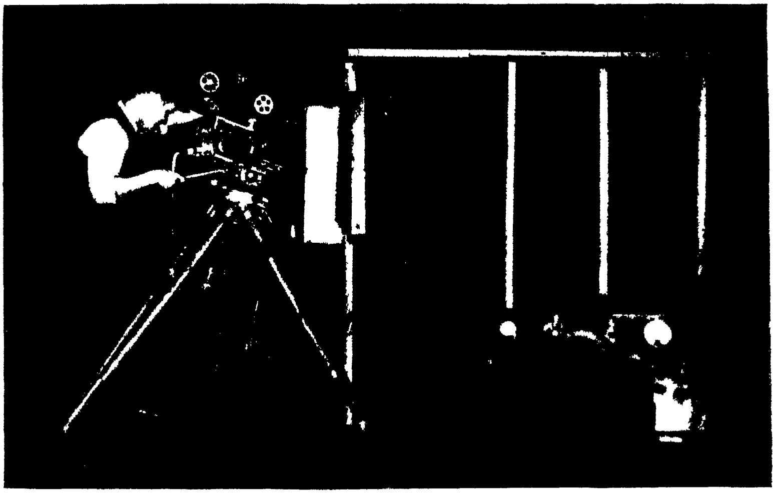

Fig. 4. The outside of the sound-proof booth and the movietone apparatus in use.

This cage was placed on a pedestal in a sound-proof booth. Close against the wire-screen back of the cage was put a highly sensitive Western Electric condenser microphone unit. Photographs of the apparatus are shown in figures 3 and 4. These photographs and, indeed, the opportunity to study the film are by courtesy of the Fox Company.

The chirping of *Gryllus*, as we hear it, seems to be a succession of shrill, slightly trilling notes lasting for about a tenth of a second and separated by pauses of about half a second, the number of notes per minute depending, within limits, on the temperature (unpublished observations, not to be confused with published records of *Œcanthus*, crickets belonging to a different subfamily). An interesting thing which an examination of this movietone showed at once is that each of what we hear as continuous sounds is made up of from two to four (rarely either one or more than four) separate "pulses" with intervals of quiet.

Apparently each of these pulses is due to a single scraping of the wings, the pauses between them representing the time required by the cricket for changing the direction of wing movement or else for getting back to the starting point. The fact that there is no record of sound between the pulses indicates that the wings do not continue to vibrate after the rubbing stops (see below concerning the number of vibrations as compared with the number of teeth) or that, if vibrations do continue, either the amplitude is not sufficient to affect the microphone or they are vibrating at a frequency above about 8000 cycles per second.

Out of about 70 chirps measured to describe this feature, 48 consisted of only three pulses each, and 15 had four pulses. Five had only two pulses and several were too faint or irregular to measure, they appearing to be trials at chirping rather than real chirps. The intervals between the pulses averaged 0.017 second (extremes, 0.011 and 0.025) and there were no significant differences between the average lengths of the successive intervals. Since the ordinary human ear does not clearly distinguish a pause of about 0.02 second, the succession of pulses seems to it to be a continuous or, at best, a slightly "wobbly" sound.[1] The pauses between chirps (not the definite cessations from chirping) range from 0.28 to 2.88 seconds, this maximum time possibly being an actual stop, although full stops usually last much longer than three seconds. The average pause between chirps was 0.51 seconds.

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[1] The inability of the human ear to catch very short pauses in sound has an important bearing on the discussion of the frequently reported synchronism of tree-cricket chirps. Lutz (1924, 'Insect Sounds,' Bull. Amer. Mus. Nat. Hist , L, p. 357) said: "Two *Œcanthus nivæus* were on one of my vines chirping in what seemed to be perfect unison. They were about six feet apart and I took a position about midway between them Then, by careful concentration I could listen to one without paying attention to the other. One was averaging 105 chirps per minute and the other 107. Such being the case, there could not be unison, yet the chirps were so rapid and it was so difficult to keep my attention fixed on both at once that, even when I tried, I could scarcely detect the instant at which one of the insects was silent while the other was chirping. . . . Chirping in unison, a thing that would be ideal proof that tree-crickets hear each other if it were true, does not seem to be as definitely established as one could wish it were." In the absence of definite data for high-pitched, low-amplitude notes, let us suppose that the human ear, like the human eye, does not perceive pauses of less than about one-sixteenth of a second. It will be an interesting exercise in rather simple mathematics for those who are convinced of synchronism to calculate the relative number of times per hundred chirps that an average man could detect the "independent" chirps of the two crickets just mentioned. Since there are no published data concerning the relative lengths of sound and pause in the *Œcanthus* chirp, the present data for *Gryllus* might be used, making the ratio as 1 is to 5. However, if the rate of chirping of an individual cricket is dependent upon temperature, clearly there can be no synchronism unless all of the crickets are at the same temperature.

In speaking of the pulses which make up a single chirp, it is desirable to number them backwards. This is because it was found that, while there was rarely any doubt about the last pulse, the chirps sometimes start off with faint, short bits of sound-record which may be separate pulses or merely an interrupted first pulse.

Considering the 63 chirps referred to above as having at least three definite pulses, the time consumed by the last pulse averaged 0.027± 0.0003 secs.; by the next to the last, 0.025±0.0003 secs.; by the second from the last 0.018±0.0004 secs.; and for the fifteen third from the last pulses the average duration was 0.006 seconds (extremes, 0.002 and 0.008).

In other words, the average tempo of the chirping of this specimen of *Gryllus assimilis* under the conditions of the experiment was:

Sound.—	(0 006)		0.018		0 025		0.027	
Interval.—		(0 017)		0 017		0.017		**0.5**

Each pulse usually starts and ends faintly, as is shown by the relative intensities of the lines on the sound-record (see Fig. 5), but there is no practical way of making this statement more concrete.

A further interesting thing about these pulses is their definite shift of pitch. Pitch can be determined from the sound record either by counting the number of cycles in a unit length of film (unit portion of a second) or by measuring the amount of film occupied (time taken) by a unit number of cycles. Both methods were used, each on a different part of the film.

Taking up the first method, the film was studied under a magnification such that one division of the micrometer scale had a time equivalent of 0.0001 second and the number of cycles (to the nearest complete cycle) was recorded for successive twenty-division units. Since the pulses regularly start and end weakly, it usually happened that there are a few cycles (rarely more than five or six) at each end of the pulse which had to be neglected because of uncertainty. This and the previously mentioned fact that the counting was done to only the nearest complete cycle, ignoring fractions of a cycle, should be remembered in what follows, but these sources of error seem unimportant for the use made of the data. There is a further qualification to what follows: Since we are to consider a shift in pitch during a pulse, only reasonably long pulses will be considered, namely those lasting at least eight time-units, about 0.016 second.

With these qualifications, we found the averages shown in Table 1.

Table 1.—Average Number of Cycles per Second in Successive Periods of 0.002 Second.

0.002 Second Units	Second from Last Pulse	Next to Last Pulse	Last Pulse
First	4619	4603	4636
Second	4690	4647	4664
Third	4667	4675	4692
Fourth	4738	4690	4720
Third from Last	4667	4531	4622
Second from Last	4595	4502	4510
Next to Last	4357	4473	4356
Last	4286	4300	4258
No. of Observations	20	33	34

To be oriented with respect to the familiar musical scale, one should remember that "middle C" of a piano as usually tuned has 256 cycles per second and that each higher octave has twice the number of the preceding one. Hence, the fourth C (called C′′′′′) above "middle C" has 4096 cycles per second; D′′′′′ has 4608; and E′′′′′ has 5120. Accordingly, these figures indicate that the cricket was chirping, so far as its fundamental notes were concerned, in the octave just beyond piano range, and that each pulse starts at about D′′′′′, rises a bit, maintains that note and then suddenly drops nearly a full note to almost within piano range. Such a performance would, in musical terms, be called a beautifully executed "slur" such as would be possible for an expert violinist, except that the cricket does it in less than 0.03 second and then in less than 0.02 second repeats it almost exactly. How exactly is indicated by the fact that among the 969 time-units for which the number of vibrations were counted to the nearest complete cycle (including those in the middles of the pulses) none had less than 8 cycles and none more than 10, representing a range of from 3810 to 4762 cycles per second. However, for the reasons mentioned above, the exact details of these statements should not be taken too seriously. Somewhat greater accuracy was obtained by the considerably more laborious method of measuring under a higher magnification the time taken for successive groups, each of five complete cycles.

The microscope was set so that each division of the micrometer was the equivalent of 0.0008 inch of film or 0.00004 second of time and the results shown in Table 2 were obtained.

Table 2.—Average Number of Cycles per Second in Successive Five-cycle Groups.

Groups	Next to Last Pulse	Last Pulse	Last Minus Next to Last
First	4427±16	4476±17	+49±23
Second	4434±12	4484±15	+50±19
Third	4482±14	4499±11	+17±18
Fourth	4474±12	4556±18	+82±22
Fifth	4499±15	4531±14	+32±21
Sixth	4523±13	4546±13	+23±18
Fifth from Last	4514±12	4499± 8	—15±14
Fourth from Last	4438±11	4468±16	+30±19
Third from Last	4365± 9	4357±10	— 7±13
Second from Last	4366±14	4308±11	—56±18
Next to Last	4263±10	4202±12	—61±16
Last	4197±14	4140±14	—34±20

These measurements, taken in a different way on a different part of the film, confirm the statement that a pulse starts at a fairly high pitch, increases somewhat, and then drops to a relatively low pitch. It will be noted, furthermore, that the average last pulse of a chirp starts at a somewhat higher and ends at a somewhat lower pitch than the average one which precedes it. The differences, taken singly group by group and considering their probable errors, are not highly significant but, taken as a whole, indicate that this may be true, especially as the less detailed data given in Table 1 are in accord. The possible meaning of this will be discussed later.

There are two points concerning which one could wish more definite information than the available data give. One is as to whether each sound cycle corresponds to a tooth of the file and the other is as to whether the wings scrape in each direction, it being possible but not generally believed that they scrape only in one position and then return to the starting point without scraping.

It has been mentioned that Kreidl and Regan, watching a white dot on a wing by interrupted light, estimated that the wings of *Gryllus campestris* swing back and forth six or eight times per second. We have shown (page 7) that in a single chirp of *Gryllus assimilis* the lengths of individual pulses not only vary but that the average lengths of the different pulses vary; also, that there is a variable but relatively considerable pause between chirps. If the same thing be true of *Gryllus campestris* it would seem that the strobloscopic method would give no or at least quite unreliable information concerning the rhythm of the wing-strokes. Since Kreidl and Regan lay great stress on their findings, it is to be presumed that *Gryllus campestris* has a more constant and continuous rhythm than our specimen of *Gryllus assimilis.*

If, for purposes of discussion and comparison, we consider that an average chirp of *Gryllus assimilis* under the conditions of the experiment is made up of three pulses each 0.023 second long with two intervals of 0.017 second and that there is a pause of 0.5 second between chirps, each chirp and pause would last about 0.6 second or, stating it the other way around, there would be 1.67 chirps per second. Since we assume three pulses per chirp, this would mean five pulses per second; but since we included the half-second pause between chirps, this is not the RATE of the pulses. If each pulse be considered to take 0.023 second and each interval 0.017 second, the total time taken would be 0.04 second, or the rate of the pulses would be 25 per second. If each pulse represents a complete back and forth swing of the wings, there being a scraping in one direction only, this would also be the rate of the wing motions. If, on the other hand, the wings scrape in each direction and each pulse represents a scraping, the rate of wing motion would be only 12.5 complete swings per second. Considering the probability of differing speeds of different species or even individuals and the fact that our cricket may have been chirping in a higher temperature than theirs, the difference between the rate of wing motion given by them (say 7 per second) and 12.5 per second is not unreasonably large and would indicate that the wings scrape in each direction.

Unfortunately, the movietone pictures do not help us here because there are only 24 per second, but another indication that the wings scrape in each direction is the shortness of the interval between pulses. If it takes 0.023 second to scrape in one direction, it is not probable that the cricket can stop the motion in that direction, separate the wings so that they will not scrape while going in the opposite direction, return them to the starting point, stop that motion, bring the wings together again, and start a new scraping, all in 0.017 second.

Quite aside from the complicated physics of the natural periods of the wings vibrating as wholes and in parts, the number of vibrations in a pulse is a further indication that each fundamental air-wave is caused by definite up and down movement due to the scraping of an individual tooth. If any pulse had undoubtedly more cycles of sound-waves than there were teeth in a file, this idea would have to be abandoned. Of 109 pulses studied with this in view and having at least 80 cycles, twenty-seven had from 80 to 89, seventeen from 90 to 99, thirteen from 100 to 109, ten from 110 to 119, twenty-two from 120 to 129, nineteen from 130 to 138, and only one had more, it recording 142 cycles, the end ones being very faint and hazy. Since there were 180 teeth in the file of the cricket which made these chirps the idea is, to say the least, not thrown out of court on this count. Furthermore, if there be a similar variability in *Gryllus campestris*, it would suggest that Kreidl and Regan were not fully justified in taking a single—and that nearly the maximum—number, 131, as the basis of their calculation.[1]

A still further and rather more convincing indication that each sound-wave corresponds to a tooth is found in the comparison of the spacing of the teeth with the differences noted on page 9 between the last pulse and the one which·precedes it.

Measuring in micrometer divisions (when each division =0.00024 inch) the distance occupied by 10 teeth, starting from the end of the file which is near the anterior (outer, as the wing is usually held) border of the wing, the distances occupied by successive ten teeth of the used file of the individual whose chirps were recorded on this film were 36, 35, 36, 38, 38, 40, 41, 41, 39, 39, 36, 36, 33, 31, 29, 28, 23 and 18 divisions. Clearly there is a regular, progressive change in the sizes or spacing of the teeth from one end of the series to the other and the larger (at least, farther from middle of one to middle of the next) teeth are nearest the front (outer) end of the file where the wing starts to bend over the side of the cricket's body.

If we suppose that the pitch of the sound, the number of cycles per second, depends upon the number of teeth scraped per second, this pitch would be a function of both the speed of the wing motion and the spacing of the teeth. If either of these were constant the pitch would then depend on the other. If each varied, changes in the pitch would depend most upon the one which varied most. If the rate of wing motion were practically constant and one pulse were caused by scraping from the outer to the inner end of the file (spreading the wings apart), the next by scraping from the inner to the outer end (closing the wings), the effect would be that one pulse would start out at a low pitch (the teeth being large and, so, not many per unit distance), getting even a bit lower, and then increasing gradually and considerably as the region where there are more teeth per unit distance is reached. On the return stroke the sound would start at its highest pitch, gradually and for a relatively considerable time get lower, hold at its lowest for a bit and then slightly increase. Neither of these happens, as is shown by Tables 1 and 2. Therefore, either the fundamental pitch does not depend upon the rate of scraping teeth or the rate of wing motion is not constant.

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[1] Kreidl and Regan give the width of a single tooth on the file of *Gryllus campestris* as 0.04 mm. It is not clear that this means 25 teeth per mm. because they say nothing concerning the spaces between teeth, but, as this space is relatively small at any rate, we may consider that such is an approximate average. Since they give the total number of used teeth as about 131, this would make the length of the file at least 5.24 mm. or at least 0.21 inch. The file of the *Gryllus assimilis* which made the present movietone record had 180 teeth on a file-length of 0.15 inch. This makes an average of 1200 teeth per inch, or about 0.02 mm. per tooth. Accordingly, it would seem that the Kreidl and Regan *Gryllus campestris*, as compared with our *Gryllus assimilis*, had a file-length about 1.4 as great, each tooth about twice as large, and takes about 3.5 times as long to make a stroke.

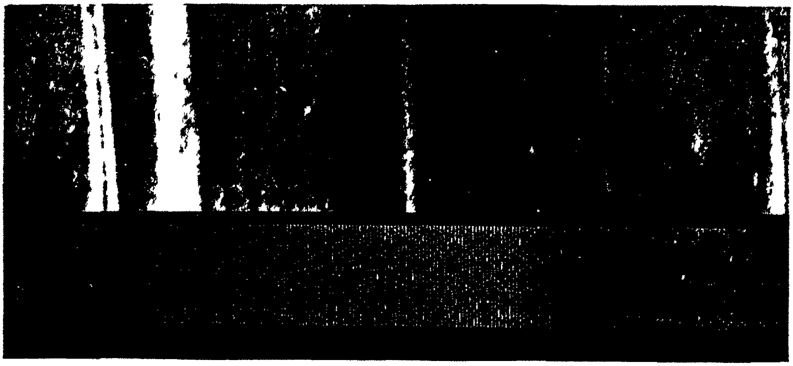

Fig. 5. Includes one "pulse" on the "sound-track." Note that the lines, each representing a sound-wave, are fainter at the ends than in the middle.

Suppose we take the latter alternative and, for the moment, disregard the variation in the size of the teeth. Then, Tables 1 and 2 would indicate that each wing stroke starts at a rather rapid rate (the pitch being fairly high), gets a little more rapid, holds that speed for a bit, and then slows up (the sound consequently decreasing in pitch) as the end of the stroke is reached in preparation for reversing the motion for the next stroke. This would give us the main feature of what we find and seems reasonable. Now add the variation in the teeth. As the wings spread apart the large (or wide-spaced) teeth are used first and, so, the pitch would be relatively lower than at the start of the closing of the wings when smaller (more per unit distance) teeth are used first. Likewise, the end of the spreading stroke would give a relatively higher pitch than the end of the closing stroke. It was remarked in connection with Table 2 (page 9) that the next to the last pulse of a chirp starts at a relatively lower pitch and ends at a relatively higher one than does the last pulse. This notion, then, appears to agree with the record and, furthermore, one might expect that a chirp would end with the wings closed although we know of no observations on this point.

A supplementary bit of evidence may be the fact that each pulse starts and stops faintly. (See page 7 and figure 5.) The teeth at each end of the file tend to be less distinct than those in the main part of the series and may, for this reason, make poor contact with the scraper. However, poor contact could, of course, be brought about by simply not pressing the wings close together. This is doubtless the explanation of faintness throughout many pulses, particularly the first one or two of a chirp.

On the whole, while freely admitting that not only are more data much to be desired but that some of the foregoing argument is on a rather slender thread, it seems fairly certain that crickets chirp by moving the wings in either direction, that each principal air-wave is caused by the "fanning" of the wing as a tooth goes over the scraper, and that the pitch of the sound is a direct function of the number of teeth scraped per second. If this be true, it might be expected that differing physiological and psycological states of the cricket would alter the pitch of its chirp.

Since the speed of such insect movements as have been studied has been found to be, within limits, a function of temperature, the chirping of a *Gryllus* would, presumably, be shriller at high than at low temperatures. This is very roughly confirmed by observations in the field but we have no accurate data. Those of us who have reared many crickets think that we can tell by intangible differences, possibly pitch, in their chirping "whether they are courting females, defying other males, or just passing the time" but here, again, we have no definite data. However, the present movietone record shows, out of the several hundred examined with this in mind, two successive chirps that were noticeably different from the rather monotonous remainder.

The first of these chirps started off with two pulses too weak to measure accurately and then ended with a strong pulse which reached a maximum of 9376 cycles per second and fell to a minimum of 8037, the average being 8195 cycles per second.[1] This was almost immediately followed by a second chirp of which the first pulse was too weak to measure, the second pulse ranged from 5626 to 5114 (average, 5544), and the third (last) pulse ranged from 5626 to 4688 (average, 5200) cycles per second. What excited this cricket so that it chirped thus shrilly, reaching higher than D'''''' of our musical scale (more than five octaves above "middle D"), we do not know. Both before and after this it chirped "normally" but it showed that crickets can change the pitch of their chirping. Since there is no evident lower limit except the point where the waves are so slow that they will not blend into a continuous note, the cricket has a theoretical range of at least eight octaves but, since intensity of sound varies as the product of the squares of amplitude and pitch and since the amplitude of the cricket's chirp is at best small, at least we could not hear a low-pitched chirp.

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[1] These rates are greater than the approximate "practical" maximum mentioned above for the recording apparatus However, we believe that they are reasonably accurate. At least, there is no doubt about the chirp being abnormally shrill.

If the fundamental pitch of a chirp is only a matter of fanning the air by the whole wing, of what use is the "drum-head" mentioned in our first paragraph and "supposed to increase the efficiency of the wing as a sound-producing organ"? Would a wing having the simple, network venation of the female cricket's wing but supplied with a file and scraper be just as efficient? Possibly. One thing that this drum-head probably does is to add to the sound-waves which we hear when a cricket chirps other notes of exceedingly high pitch and low amplitude which affect neither our ears nor the movietone film. It is made up of two small membranes supported by continuous rigid rims and, so, almost certainly these membranes have natural periodicities of vibration. If they are set vibrating by the rapid shaking of the whole wing it is quite possible that they may continue to vibrate in their natural periods even after the wing as a whole has stopped. If that be their only function it would imply either that the crickets can hear sounds far shriller and of much less amplitude than those recorded in the present experiments or that, the crickets not hearing them, even this function of the drum-head has no biological value.

It would be exceedingly interesting to determine whether there are, in fact, these supplementary components in the cricket's chirp, also what, if any, harmonics of the fundamental pitch there are. Furthermore, it would be of interest to get for comparison with the present record accurate data concerning the sounds made in a similar fashion by such insects as the katydid and also concerning sounds made in quite different ways by such insects as short-horned grasshoppers, cicadas, certain beetles, mosquitoes, and so on. There have arisen among insects very diverse methods of making sounds. Are all equally efficient and do they serve a really important purpose in the lives of the insects? If not, why have they developed and how?

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MEMBRACIDÆ IN THE AMERICAN MUSEUM OF NATURAL HISTORY

By Frederic W. Goding

In the material examined were 1227 adults and a large number of immature specimens. Twenty-five of the species were undescribed. It is evident from this and other studies that the membracid faunæ of Central and South America cannot be separated, as most of the species supposed to be limited to the one have been found to inhabit both; and, moreover, that many forms described as species, especially in the genera *Membracis*, *Bolbonota*, *Erechtia*, *Leioscyta*, *Aconophora*, *Heteronotus*, *Ceresa*, *Gelastogonia*, *Hille*, *Maturna*, *Telamona*, *Micrutalis*, and *Tragopa*, are color-varieties which can be correctly placed only after more definite characters have been discovered or their life histories are known. Until then, the naming of such varieties is a great convenience.

Where no locality records are given here, there are none on the specimens. The types of the new species herein described are in The American Museum of Natural History, as well as most of the paratypes; some of the paratypes and duplicates are in the writer's collection. My thanks are due to Dr. F. E. Lutz, Mr. C. E. Olsen, and other officers of the Museum for many courtesies received.

NEW-WORLD MEMBRACIDÆ

ÆTHALIONINÆ

Æthalionini

ÆTHALION Latrielle

reticulatum Linnæus. Espirito Santo, Brazil; *reticulatum albonervosum* Blanchard, Manáos, Brazil.
apicalis Walker. Peru.
servillei Laporte. Peru.
basalis Walker. Colombia; Bolivia.

Tolanini

TOLANIA Stal

semilucida Stal. Chapada, Brazil.
opponens Walker. Chapada, Brazil.
felina Germar. Chapada, Brazil.

Abelusini

ABELUS Stal

lectuosus Stal. Peru.

CENTROTINÆ

Acuminatini

ŒDA Amyot and Serville

inflata Fabricius. Brazil.

LYCODERES Germar

gaffa Fairmaire. Rio Grande do Sul, Brazil.
galeritus Lesson. Rio Grande do Sul, Brazil.
hippocampus Fabricius. Assu, Rio Grande do Sul, Brazil.
burmeisteri Fairmaire. Rio de Janeiro, Brazil.
emarginatus Fabricius. Pará, Brazil.
insoleta Walker. Espirito Santo, Brazil. (This unmutilated example proves that the species belongs to *Lycoderes*, not to *Stegaspis*.)

STEGASPIS Germar

fronditia DeGeer. Assu, Ignapé, Brazil; Pachitea, Peru; Mapiri, Bolivia.
folium Stoll. Assu, Brazil.
viridis Funkhouser. Port of Spain, Trinidad. Paratype in A. M. N. H.

TUMECAUDA, new genus

The head with the eyes as broad as the base of the pronotum, its base strongly sinuate; the ocelli are about equidistant and level with the center of the eyes; the margins of the genæ are sinuate; the clypeus is extended below the apical margin.

The pronotum is moderately elevated, rugose, strongly punctured, and tuberculate with short thick spines; the median carina is percurrent, the humerals prominent, and conical; the suprahumerals are large, triquetrous, oblique, the summit bifid; the posterior process is crested and curved from the base; it is moderately distant from the scutellum and curved downward, touching its apex; the dorsum of the apical area is elevated in an elongate convex lobe, its apex reaching the middle of the abdomen; the general surface is spinose.

The tegmina are opaque, not coriaceous, with three longitudinal veins, the radial vein simple, the ulnar veins forked some distance from the base; the first ulnar vein is forked at the middle, enclosing the middle discoidal cell; the second ulnar vein not forked; there are three discoidal cells, the bases of the exterior and the interior cells truncate; the five apical cells have their veins oblique; the clavus is gradually acuminate from the base of the apex; the apical tips are acutely angulate without a marginal limbus. The wings have four apical cells, the second cell large, its base truncate.

The scutellum is exposed, triangular, its apex bidentate.

The abdomen is large and nearly as long as the tegmina. The legs are simple, the hind tarsi longest.

TYPE.—*Tumecauda schæfferi*, new species.

Superficially this genus resembles *Centruchoides* Fowler, the form, suprahumerals and venation being similar; it differs in the location of the ocelli, the longer posterior pronotal process which is distant from the scutellum, and the elevated node on the apex from which the name is derived.

Tumecauda schæfferi, new species

Figure 1

The head is dark fuscous, pubescent, with a pale tubercle above each ocellus, and an acute tubercle at the bases of the genæ; the clypeus is large, cardiform, reddish, and narrowed toward its obtuse apex.

The pronotum is black, rugose, and covered with short spines; the median carina is serrate anteriorly; the suprahumerals are twice longer than broad with the margins parallel, triquetrous, spinose, the outer tooth at the summit prolonged in a stout spine; the apical node of the posterior process is twice longer than high, and covered with rugæ.

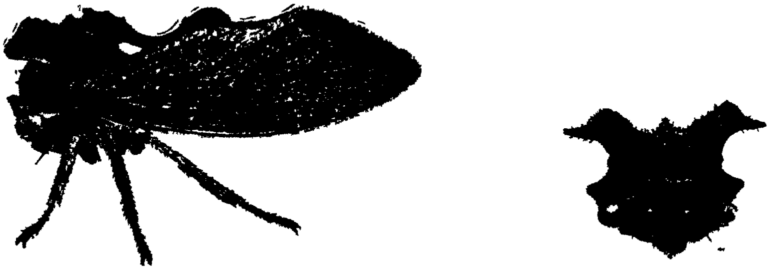

Fig. 1. *Tumecauda schæfferi*, new species. Magnified five diameters. Drawn by Ignaz Matausch.

The tegmina are gray, two and one-half times longer than broad, covered with a gray pubescence and small black tubercles and elevated lines; the costal margin and the claval margin to the interior angle curved, its apical margin oblique and straight.

The scutellum is reddish, the apex paler.

The abdomen is reddish-testaceous, the margins of the last two segments yellow, the ventral surface paler, the last segment in the female with a rounded notch. The legs are yellow mottled with fuscous, the tarsi fuscous.

Type.—Female; long. cum teg. 10 mm.; lat. inter hum. 3.5 mm.

Collected on the Huachuca Mountains, Arizona, U. S. A., by Mr. C. Schæffer, for whom the species is named. No paratypes.

This species has a superficial resemblance to the figure of *Centruchoides laticornis* Fowler, plate x, figure 6, in 'Biologia Centrali-Americana,' Homoptera, II.

BOCYDIUM Latrielle

tintinnabuliferum Lesson. Espirito Santo, Brazil; Peru.
globulare Stoll. Assu, Rio Grande do Sul, Brazil.
germari Gúerin. Peru.

Bocydium bullifera, new species

The head is nearly quadrangular, not punctate, with large prominent eyes, and as broad as between the humerals, and the base straight; the ocelli are near the eyes and the base, the margins of the genæ sinuous with tips rounded; the clypeus is long, narrow, extended one-third below the genæ; a stripe of pubescence extends from the ocelli to the apex, often obsolete.

The pronotum is similar to that of others of the genus, black, not punctate; the summit of the vertical spine is formed into a considerable bulb, and joined by a minute pedicle to the base each side with an ovoid bulb of similar size pointing forward; this is followed by a globoid bulb four times larger with a constriction only between, and a slender thread-like spine from its middle extended outward; everywhere are long scattering white hairs; from its summit is emitted a slender spine which is curved near its base obliquely downward and backward, its tip nearly as long as the tegmina; there is a median carina on the metopidium, and one behind the vertical spine which also has a carina on each side; the superior margin of the spine is longitudinally canaliculate; the humerals are triangular and acutely subprominent; the lateral margins are obliquely narrowed from the humerals, the hind margin truncate. Vertical stripes of pubescence are often present on the metopidium.

The scutellum is triangular, the base tumid and pubescent, the apex white and rather obtuse.

The tegmina are long, narrow, the bases piceous, opaque, coriaceous and punctate; the clavus is vitreous, with one vein which joins the middle of the interior margin, both being broadly piceous, the exterior margin reddish, and gradually narrowed to the apex; the corium is vitreous, the veins and margins broadly piceous, with one discoidal cell in the fork of the radial vein, and five apical cells. The wings have four apical cells.

The abdomen is testaceous; the legs are simple, yellow, the tarsi of equal length.

TYPE.—Female; long. cum teg. 7 mm.; lat. 1.5 mm. The two paratypes are similar to the type, one with the basal half of the costa reddish. All are from Bolivia.

The species of the genus may be separated by the following key.

1.—Front bulbs lengthily petiolate....................2.
All bulbs sessile, or the petiole represented by a constriction....................4.
2.—Bulbs small, equal....................*tintinnabuliferum.*
Front bulbs one-half the size of the lateral bulbs....................3.
3.—Abdomen and legs black....................*globuliferum.*
Abdomen red or yellow; legs yellow....................*globulare.*
4.—Bulbs small, equal; posterior pronotal process as long as the abdomen..*germari.*
Lateral bulbs nearly four times longer than the intermediate bulbs; posterior pronotal process nearly as long as the tegmina....................*bullifera.*

STYLOCENTRUS Stal

ancora Perty. Peru; Bolivia.
championi Fowler.

Hebesini

CAMPYLOCENTRUS Stal

brunneus Fowler. Matamoros, Mexico.

MEMBRACINÆ

Membracini

MEMBRACIS Fabricius

DIVISION 1

maculata Stoll. Colombia; Assu, Santarem, Brazil; Peru.
foliata Linnæus. Assu, Brazil.
foliata c-album Fairmaire, (variety). Minas Geraes, Brazil; Peru.
albolimbata Fowler. Peru.
trimaculata Fairmaire. Peru.
arcuata DeGeer. Rockstone, British Guiana.

DIVISION 2

nigrifolia Stoll. Espirito Santo, Brazil; Tumatumari, Demerara, British Guiana.
elevata Fabricius. Rio de Janeiro, Chapada, Brazil; Chanchamayo, Peru; Mapiri, Bolivia; Bartica, British Guiana.
lefebvrei Fairmaire, (9 examples, 1 orange-spotted). Assu, Brazil.
rosea Fairmaire. Beni, Bolivia; Peru.
peruviana Fairmaire.
confusa Fairmaire.
tectigera Stoll. Bartica, British Guiana.
mexicana Guérin. Pacaca, Costa Rica; Matamoros, Mexico; Loja, Ecuador.
ephippiata Stal. Sta. Catharina, Therezopolis, Chapada, Brazil; Bolivia; British Guiana; Peru; Frijoles, Canal Zone, Panama.
ambigua Fairmaire. Santarem, Brazil.
tricolor Fairmaire. Bartica, Tumatumari, British Guiana; Assu, Brazil; Tena, Ecuador.
serratipes Goding, (paratype). Tena, Ecuador.

ENCHOPHYLLUM Amyot and Serville

Enchophyllum

longicollum Stoll. São Paulo, Brazil.
lanceolatum Fabricius. Rockstone, Tumatumari, British Guiana.

They may be identified as follows:

Length from head to tips of tegmina 9 mm., from summit of front horn to tips of tegmina 13 mm.; metopidium strongly sinuate vertically; apex posterior process extended to apex fifth apical cell corium; summit of front horn slightly dilated;

pronotum black or brown, small spot at base of median carina and two dorsal spots yellow . . ..*longicollum.*

Length from head to tips of tegmina 5 mm., from summit of front horn to tips of tegmina 7 mm.; metopidium straight, not sinuate; summit of front horn compressed; posterior process extended to middle of fifth apical cell corium; pronotum black or brown, usually spot on base of median carina and two dorsal spots yellow. *lanceolatum.*

cingulatum Germar. Pará, at Brazil; Bolivia; Peru.
nigroluteum Funkhouser. Chapada, Brazil.
quinquemaculatum Fairmaire. Espirito Santo, Brazil.
imbelle Stal.
fasciatum Fabricius.

ENCHENOPA Amyot and Serville

Enchenopa

dubia Fowler (?). Pacaca, Costa Rica; Matamoros, Mexico.
gladius Fabricius. Chapada, Brazil; Mérida, Venezuela.
sericea Walker. Chapada, Brazil.
monoceros Germar. Rio de Janeiro, Rio Grande do Sul, Brazil.
squamigera Linnæus. Chapada, Espirito Santo, Brazil; Callanga, Peru.
concolor Fairmiare (form *nigroapicata* Stal). Chapada, Assu, Brazil; Mapiri, Peru.
gracilis Germar. Chapada, Brazil; Rockstone, British Guiana.
ignidorsa Walker. Chapada, Assu, Brazil.
ephippii Buckton. Espirito Santo, Brazil.
albidorsa Fairmaire. Rio Negro, Assu, Chapada, Brazil.
binotata Say. Pacaca, Costa Rica; Mexico.
quadricolor Walker. Rio Grande do Sul, Brazil.

Campylenchia

curvata Fabricius.
hastata Fabricius. Chapada, Brazil.

Bolbonotini

BOLBONOTA Amyot and Serville

Tubercunota

inæqualis Fabricius. Corumba, Chapada, Brazil; Narangapata, Ecuador.
pusio Germar.
bituberculata Stal. Peru; Tena, Ecuador.
corrugata Fowler.
tuberculata Fabricius. Narangapata, Ecuador.

Bolbonota

nigrata Funkhouser. San Carlos, Pacaca, Costa Rica; one male, Bolivia.
melæna Germar. Rio Grande do Sul, Brazil.
pusilla Fairmaire. Chapada, Brazil.

globosa Fairmaire. Pacaca, Costa Rica.
aurosericea Stal.
pictipennis Fairmaire. Pacaca, Costa Rica; Mapiri, Bolivia.

ERECHTIA Walker

decipiens Fairmaire. São Paulo, Brazil.
sallei Fowler. Chapada, Brazil.
torva Germar. Chapada, Brazil.
brevis Goding, (paratype).
pulchella Goding, (paratype).
succedanii Buckton. Chapada, Rio de Janeiro, Brazil.
carbonaria Germar. Peru.
pœcila Germar. Bolivia; Peru.
nigrovittata Fairmaire. Chapada, Brazil.
rufidorsa Goding, (paratype). Baños, Ecuador.
sanguinolenta Fairmaire. Tena, Ecuador.
minutissima Goding, (paratype). Tena, Ecuador.

LEIOSCYTA Fowler

pruinosa Haviland. Kamakusa, British Guiana.
nitida Fowler. Chiriqui, Panama.
maculata Funkhouser. Callanga, Peru.
spiralis Haviland. Chapada, Brazil.
bituberculata Goding, (paratype).

Pterygiini

GUAYAQUILA Goding

xiphias Fabricius. Chapada, Brazil.
compressa Walker.
pubescens Walker. Chapada, Brazil.
sulphurea Golding, (paratype). San Jacinto, Chira Valley, Peru.
vexator Goding, (paratype). Narangapata, Ecuador.
roreriana Goding, (paratype). Narangapata, Ecuador.
olseni Goding, (type). Pricta, Republic Honduras.

Guayaquila mirucornua, new species

The head with the eyes is as broad as the base of the pronotum, brown, densely pubescent, with numerous shallow longitudinal furrows, and the base arcuate; the ocelli are some nearer to and even with the center of the eyes; the margins of the genæ are shining black, and strongly sinuate; the clypeus is large, the base arched, very broad toward the rounded spatulate apex, its sides angulate at the middle, and extended one-half below the lateral margins.

The pronotum is chestnut-brown and densely pubescent; the metopidium is obliquely ascending forward, nearly horizontal, and continuous with the inferior margin of the front horn, its median carina obsolete; the humerals are broad at the bases, and rather prominent; the front horn is black, porrect, and strongly curved upward from the middle; seen from the side, its base is as broad as the altitude of the pronotum, gradually narrowed and compressed, its summit obtusely rounded, the hind margin concave, its median carina being continuous with the slightly convex dorsal carina; the posterior process is as long as the abdomen, its tip reaching to midway between the apex of the clavus and the tips of the tegmina, its median carina being slightly convex and obsolete at the middle, and elevated at the apex.

The tegmina are long, narrow, with the basal half subopaque, punctured and densely pubescent, paler translucent on the apical half; the costal and posterior margins are straight; there are two discoidal and five apical cells; the apices are angular. The wings have four apical cells, the bases of the first and third cells stylate; the wings are fuliginous.

The abdomen is robust, concolorous, the margins of the segments of the basal half yellow, and the last segment of the female with a V-shaped notch. The legs are testaceous, the front and middle tibiæ well dilated and flattened, especially the middle pair, the tarsi being of equal length.

TYPE.—Female; long cum teg. 10 mm.; cum corn. 14 mm.; lat. 4 mm. The paratype, a male, is similar but smaller. All from Honduras, Central America.

The excessively broad front horn separates this species from all others of the genus.

HYPSOPRORA Stal

albopicta Funkhouser. Bolivia.
coronata Fabricius. Rio Grande do Sul, Brazil.
trituberculata Stal. Kaieteur, British Guiana.
insignis Buckton. Bartica, British Guiana.

SPHONGOPHORUS Fairmaire

Sphongophorus

balista Amyot and Serville. Tonala, Chiapas, Chiriqui, Panama.

Cladonota

undulatus Walker. Brazil.
facetus Walker.

NOTOCERA Amyot and Serville

satanas Lesson. Brazil.
bovina Stal.
tuberosa Fairmaire. Corumba, Brazil.
bituberculata Fowler. Rio Grande do Sul, Brazil.
subsimilis Walker. Ceará, Brazil.
cruciata Stoll, (large). Brazil.
alataruna Goding, (paratype; large).
brachycera Fairmaire.

HOPLOPHORIONINÆ

Hoplophorionini

PLATYCOTIS Stal

nigrorufa Walker. Zamora, Ecuador.

METCALFIELLA Goding

pertusa Germar. São Paulo, Brazil.
fimbriata Stal. Mérida, Venezuela.
proxima Walker. Peru.
proxima variety. Rio Grande do Sul, Espirito, Santo, Brazil; Sicuani, Peru.
erecta Schmidt. Zamora, Ecuador.
gigantea Fairmaire. Baños, Ecuador.

UMBONIA Burmeister

crassicornis Amyot and Serville. Guadalajara, Jalapa, Mexico; Guatemala.
reclinata Germar. Orizaba, Jalapa, Mexico.
lutea Funkhouser. Bolivia.
curvispina Stal. Sta. Catharina, Espirito Santo, Brazil; Jalapa, Mexico.
ataliba Fairmaire. São Paulo, Brazil.
spinosa Houttuyn. Santarem, Espirito Santo, Brazil; Mérida, Venezuela; Darien, Panama; Olas de Moka, Dept. of Solola, Guatemala; Kamakusa, British Guiana.
signoreti Fairmaire. Mérida, Venezuela.
amazili Fairmaire, (one deep red). Mazatlan, Mexico.

Umbonia octolineata, new species

The head with the eyes as broad as the base of the pronotum, uneven, yellowish gray with irregular fuscous lines, the base slightly arched; the ocelli are yellow, slightly approaching, even with the upper margin of the eyes; margins of the genæ are sinuate, the tips rounded; the clypeus is rather large, its apex pointed and extended one-half below the genæ.

The pronotum is yellowish gray, densely punctate, with a large smooth scar above each eye; the metopidium is convex; the dorsal horn is situate behind the humerals, its base not broad, the front margin lightly convex toward the summit, with the tip acute and slightly recurved, its hind margin almost straight; the humerals are large, auriculate, the tips black with a red line on their hind margin; the posterior process is about as long as the tegmina and narrow; the median carina, a vitta each side in front, another each side behind the dorsal horn, and one from the summit of the horn to the lateral margin each side behind the humerals, bright red.

The tegmina are hyaline, long, narrow, partly covered, the tips obtusely rounded; there are two discoidal and five apical cells; the veins are yellow, becoming darker toward the tips. The wings have three apical cells.

The body and legs are yellow, the outer surface of the tibiæ bright red, the hind tarsi brown, and shortest.

TYPE.—Female; long. 11 mm.; lat. 6 mm.; unique. It is from Mexico.

Similar to *Umbonia curvispina* but smaller, has eight red vittæ, and the outer surface of the tibiæ is red.

Umbonia sordida, new species

The head is similar to that of *Umbonia spinosa*, with the color of aluminum mixed with rufous.

The pronotum also is similar to that of *spinosa*, but its color is a shining aluminum, faintly clouded with fuscous near and including the humerals and on the dorsum of the posterior process, the apex much darker.

The tegmina are pale gray, the veins slightly darker, with an elongate spot on the bases, and the apical veins, fuscous.

The body is sordid pale fuscous, the legs concolorous with the pronotum.

The hind tarsi are the shortest.

TYPE.—Female; long. cum teg. 14 mm.; lat. 7 mm. There are twenty six examples of similar shape and color; all from Darien, Isthmus of Panama.

This form so closely resembles *Umbonia spinosa* that it may prove to be a race of that species, but the distinctive color and numerous examples demand a separate name for it.

Potniini

ALCHISME Kirkaldy

nigrocarinata Fairmaire, variety *tridentata* Fairmaire.
ustulata Fairmaire. Chanchamayo, Peru.
bos Fairmaire. Peru.
turrita Germar. Panama.
grossa Fairmaire. Peru.
virescens Fairmaire. Chiriqui, Panama.
virescens virgata Fairmaire. Chiriqui, Panama; Venezuela; Peru.
truncaticornis Germar. Beni, Bolivia.

Alchisme elevata, new species

Immaculate yellow. The head is subtriangular, uneven, with a longitudinal furrow along the middle to the clypeus, and the base strongly arched; the eyes are black, pale-margined; the ocelli are equidistant, pale, situate on a line slightly above the center of the eyes; the margins of the genæ are sinuate, and continuous with the margins of the clypeus whose apex is obtusely pointed.

The pronotum is well elevated anteriorly, yellow, strongly punctate, the punctures along the median carina blackish; the metopidium is high and inclined backward, its summit rounded; the humerals are long, the bases rather broad, acuminate, the tips obtuse, directed outward, slightly forward and distinctly upward; the dorsum is straight from the summit to the apex and as long as the tegmina; the posterior process is long and slender.

The tegmina are long, narrow, and free, with numerous cross-veins, the apical fourth gradually narrowed to the briefly rounded tips. The wings have four apical cells, the bases of the second and fourth cells truncate.

The body is pale yellow, the legs testaceous, the hind tarsi shortest.

TYPE.—Female; long. 11 mm.; lat. int. hum. 8 mm.; alt. 5 mm.

This unique species was taken in Beni, Bolivia. It is near *Alchisme grossa* from which it differs in the sloping metopidium, the strongly rounded summit, the direction of the humerals, the free tegmina, and the arched base of the head.

POTNIA Stal

affinis Buckton, (male).
jaculus Fabricius. Chapada, Brazil.
rectispina Funkhouser. Bolivia.

HOPLOPHORION Kirkaldy

corrosa Fairmaire. Okara, Bolivia.
hebes Walker. Okara, Mapiri, Bolivia.
inæqualis Fowler. Okara, Bolivia.
triangula Germar. Okara, Bolivia.
pupa. Okara, Bolivia.

DARNINÆ

Darnini

HEBETICA Stal

convoluta Fabricius. São Paulo, Brazil; Bolivia.
limacodes Burmeister. Assu, Brazil; Surinam, Dutch Guiana; Callanga, Pachitea, Peru.

STICTOPELTA Stal

acutula Fairmaire. Tukeit, British Guiana; Corumba, Brazil; Mexico.

OCHROLOMIA Stal

suturalis Germar. Paraguay.
cruenta Burmeister. Chapada, Brazil.
denticulata Fowler. Chapada, Brazil.

DARNIS Fabricius

lateralis Fabricius. Assu, Santarem, Chapada, Brazil; Peru; Surinam; Dutch Guiana; Kamakusa, British Guiana.
olivacea Fabricius. Mapiri, Bolivia; Santarem, Brazil; Kamakusa, British Guiana.
trifasciata Fabricius. Bartica, British Guiana; Iguapé, Brazil.
partita Walker. Bartica, British Guiana.

EUMELA Stal

semiacuta Stal.

CYMBOMORPHA Stal

olivacea Fabricius. Rio de Janeiro, Brazil.
vaginata Germar. Santarem, Espirito Santo, Assu, Rio de Janeiro, Brazil; Bartica, British Guiana.
prasina Germar. Bartica, British Guiana.
bipuncta Walker. Brazil.

Cymbomorpha convexa, new species

Testaceous; the metopidium is convex to the humerals, and the dorsum conically elevated. The head is triangular, testaceous, with a broad, median, yellow vitta from the base to the apex; it is twice broader than long, the surface nearly smooth, with fine obsolete rugæ, with the base sinuate; the ocelli are equidistant, situate slightly above the center of the eyes, and are large, shining, pale yellow; the eyes are pale with large piceous spots; the lateral margins are straight, not sulcate within; the clypeus is as long as broad, the apex obtusely angulate.

The pronotum is testaceous, the metopidium convex from the base to an imaginary line between the humerals, then abruptly and almost vertically elevated to the summit which is acutely angulate, its extreme tip briefly rounded; the dorsum gradually slopes backward; the posterior process is broadly concave at the base of the subulate apical area, slightly longer than the abdomen, and extended to the apex of the fifth apical cell of the corium; the humerals are large, triangular, acute, and very prominent; the median carina is red, and is caniculate from the apex nearly to the base; the surface of the pronotum is finely punctate anteriorly, but transversely rugose behind the summit.

The tegmina are hyaline, the veins testaceous, with a red or piceous spot on the inner angle; there are two discoidal cells, the exterior cell being much the smaller, and five apical cells. The wings have four apical cells, the bases of the second and fourth truncate.

The body is robust, testaceous, the legs testaceous with the tips of the middle and hind tarsi piceous.

TYPE.—Female; long. cum teg. 9 mm.; lat. 4.5 mm.; from Chapada, Brazil, There is one female paratype which is similar, but the angle at the summit of the pronotum is more rounded, the elevation from the metopidium is less abrupt, and there is a black spot on the base of the tegmina instead of a red spot as in the type. It is from Sicuani, Peru.

This species differs from its congeners in the convex metopidium and the conical form of the pronotal elevation.

RHEXIA Stal

pallescens Fabricius. Alto Rio Wapes, Brazil.

DYSYNCRITUS Fowler

Dysyncritus lineatus, new species

The head is testaceous, one and one-half times broader than long, strongly punctate, uneven, the base weakly sinuate, and with the eyes broader than the base of the pronotum; the ocelli are much nearer to and even with the center of the eyes, minute, situate in a black foveola; the lateral margins of the genæ are lightly sinuate; the clypeus is narrow, impressed each side, with a transverse piceous furrow each side of the base to the eye, the apex black, broadly obtuse, and continuous with the lateral margins.

The pronotum is luteous, with four brown vittæ on each side, broadly convex, and densely punctate; the metopidium is slightly advanced over the head, the dorsum highest at the middle then straight to the posterior apex; the humerals are not prominent; the posterior process is broad at the base then gradually narrowed behind, with the brown vittæ extended upon the basal half, the apical half brown with a narrow subapical luteous band and far passing the tip of the abdomen and to the apex of the fifth apical cell of the corium; the dorsum is tectiform, compressed posteriorly from the summit.

The tegmina are broad, rather short, hyaline, the basal third coriaceous, opaque, piceous and punctate, with a piceous band behind the middle, the veins between being luteous; the apical veins and the exterior angle are piceous, the apex rounded, the limbus rather broad; there is one discoidal cell in the fork of the radial vein behind the middle, and five apical cells with the veins between strongly curved. The wings have four apical cells.

The chest is piceous, the abdomen sordid testaceous, the legs testaceous, the tips of the tarsi piceous.

TYPE.—Female; long. cum teg. 5 mm.; lat. 2 mm. There are two paratypes similar to the type, all from Chapada, Brazil.

The luteous color and distinct brown lines on the pronotum separate this species from the other members of the genus.

Dysyncritus nubilis, new species

Sordid yellow clouded and punctured with ferruginous. The head is as long as the width between the eyes, and with the eyes it is broader than the base of the pronotum, sordid testaceous, punctate, uneven, with a longitudinal impression on each side within the margins at the eyes; the ocelli are pale pink, shining, much nearer to and even with the center of the eyes; the lateral margins of the genæ are sinuate; the clypeus is triangular, is extended one-half its length below and continuous with the lateral margins, and the apex acutely pointed.

The pronotum is sordid yellow clouded and punctured with ferruginous, convex from the base; the metopidium is strongly projected in front of the head, is short, with a transverse piceous impression on each side at the base; the humerals are medium; the dorsum, seen from the side, is slightly convex from the summit to the posterior apex; the posterior process is broad at the base then gradually narrowed behind, the basal two-thirds being concolorous, the apical third ferruginous with a luteous subapical band, the apex passing the tip of the abdomen and reaching to the middle of the fifth apical cell of the corium.

The tegmina are long, broad, pale-yellow hyaline, the basal fourth opaque and ferruginous, punctured, except the interior basal cell, the veins piceous with yellow spots; the only discoidal cell is in the fork of the radial vein behind the middle; the five apical cells have the veins between strongly curved. The wings have four apical cells.

The chest is black, the abdomen ferruginous; the femora black; the tibiæ ferruginous at the middle; and the tarsi yellow with ferruginous tips.

TYPE.—Female; long. cum teg. 7 mm.; lat. 2.5 mm.; from Chapada, Brazil. The two female paratypes are slightly smaller, the pronotum is pale ferruginous with two yellow vittæ on each side, and the costal margin and first and second apical cells dark brown.

Nubilis differs from the known species of the genus in the long, pointed head, and the tegmina.

Dysyncritus discrepans, new species

Ferruginous, with two yellow stripes on each side. The head is yellow, ferruginous, punctured, long as broad, triangular, uneven, and with the eyes as broad as the base of the pronotum; the base is moderately arched, with four black dots; the ocelli are nearer to and even with the center of the eyes; eyes steel-gray; the lateral margins are concave, piceous and impressed within; the clypeus is longer than broad, with a smooth central ridge, and is extended one-half its length below the lateral margins, its apex black and obtusely rounded.

The pronotum is continuously arched from the base to the apex, is ferruginous, punctate, with a piceous spot above each eye, a yellow vitta curved from the base each side, and another on the lateral margin, both vittæ extended to and united on the apical third of the dorsum of the posterior process; the metopidium is vertical; the humerals are not prominent; the posterior process is broad at the base, its median carina piceous, the apical third brown or piceous with a subapical yellow spot or band, the tip extended to the base of the fifth apical cell of the corium.

The tegmina are rather short, broad, the apices broadly rounded; they are yellow hyaline; the costal, the discoidal, and the first and second apical cells brownish hyaline; the bases, except the interior basal cells, are ferruginous punctate; the one discoidal cell is in the fork of the radial vein behind the middle; the five apical cells have the veins between very strongly curved. The wings have four apical cells.

The chest is piceous, the abdomen and legs testaceous.

TYPE.—Female; long. cum teg. 6 mm.; lat. 1.5 mm. The one female paratype is similar, but the apex of the posterior process of the pronotum is piceous with a subapical yellow band. Both are from Chapada, Brazil.

It differs from *lineatus* in being smaller, and in the number of vittæ; from *nubilis* and *intectus* Fowler (from Mexico) in having stripes, and from the former in the obtuse apex of the head. The species of the genus may be separated as follows:

1.—Pronotum with stripes; apex of head obtuse..................... .....2.
Pronotum without stripes........................ ... .3.
2.—Pronotum with four stripes on each side; head broader than long....*lineatus.*
Pronotum with two stripes on each side, sordid yellow ferruginous punctate; head as long as broad.. ....*discrepans.*
3.—Apex of head acute.... . ...*nubilis.*
Apex of head obtuse... . ...*intectus.*

Aconophorini

KRONIDES Kirkaldy

incumbens Germar. Rio Grande do Sul, Brazil.
cochleata Schmidt. Rio Grande do Sul, Brazil.

ACONOPHORA Fairmaire

laminata Fairmaire. Mérida, Venezuela; Tlalepam, Mexico.
nitida Fowler. Rio Janeiro, Brazil; Chancay, Peru; Guadeloupe, Mexico.
sinanjensis Fowler. Chancay, Peru; Zamora, Ecuador.
flavipes Germar. Bolivia; Peru.

tenuicorne Walker. Cordoba, Mexico.
talpula Stoll. Mérida, Venezuela.
imbellis Fairmaire. Bolivia.
laticorne Walker. Pacaca, Costa Rico; Tlalepam, Mexico.
conifera Butler. Tlalepam, Mexico.
fusiformis Fowler. Pacaca, Costa Rica.
gracilicornis Stal. Cordoba, Mexico; Bolivia; Chapada, Brazil.
ensata Fowler. Bolivia.
femoralis Stal. Pacaca, Costa Rica; Cuernavaca, Mexico; Chancay, Peru; Bolivia.
pallescens Stal. Zamora, Ecuador.
projecta Funkhouser. Zamora, Ecuador.

Hemikypthini

NASSUNIA Stal

fortis Walker.

HYPHINŒ Stal

inermis Goding, (paratype).
camelus Gray. Ocotlan, Tlalenpantla, Guadalajara, Jojutla, Mexico; Guanajuato, Guatemala.

PROTERPIA Stal

Proterpia truncaticornis, new species

Luteous, margins of the suprahumerals parallel, their truncate tips and a transverse band extending from tip to tip, and the posterior apex, piceous, The head is yellow, twice broader than long, uneven, and with the eyes as broad as the base of the pronotum, its base sinuous; the eyes are triangular, gray; the ocelli are large, shining pale yellow, nearer to each other than to the eyes, and slightly above a line through the center of the eyes; the apical margin is broadly rounded from the eyes, emarginate each side of the clypeus which is extended below the margin, its apex densely hairy.

The pronotum is luteous, long, narrow, densely and coarsely punctate, with the median carina percurrent but nearly obsolete behind the humerals; the metopidium is vertical, its summit convex between the suprahumerals; the humerals are barely evident; the suprahumerals seen from behind are U-shaped, broad, triquetrous with sides parallel, the margins carinate, the exterior carina almost foliaceous; the inner and posterior surfaces are flat, the exterior surface concave; they are directed upward, forward, and lightly curved outward, the space between being as broad as the base of the posterior process; the summits are truncate, piceous, with a vitta on the exterior surface, two transverse vittæ, and a broad transverse band across the pronotum and on the inner surface of the suprahumerals from tip to tip, piceous brown; the posterior process is very long, narrow, compressed, tectiform, and concolorous, with three pale-brown spots on each side on the lateral margins; it is gradually narrowed to the lengthily black apex which passes far behind the tips of the tegmina; the dorsum is straight from its base behind the suprahumerals to the apex.

The tegmina are long, narrow, one-half free, their apices lengthily acuminate, the veins hairy; the basal two-thirds of the corium are sordid grayish-yellow, opaque but not coriaceous, and punctate; the clavus and the apical third of the corium smoky translucent; the three longitudinal veins are luteous, mottled, and hairy; there are two very long, narrow, discoidal cells, the interior cell double the longer, its base truncate, the exterior cell situate in the fork of the radial vein; the five apical cells are long, narrow, with the base of the third cell truncate and sessile; the limbus is broad, extending to the middle of the curved costal margin. The wings are long, broad, with four apical cells, the bases of the second, third and fourth cells truncate.

The chest is piceous, the abdomen sordid testaceous, the valves in the female piceous; the legs are long, stout, the femora black, the tibiæ brown and yellow mottled, with the margins densely white-haired, and the tarsi paler and hairy.

TYPE.—Female; long. 14 mm.;- lat. int. hum. 5 mm.; int. corn. 6 mm.; corn. long. 6 mm.; lat. 1.5 mm. The two female paratypes are similar. All from Chapada, Brazil.

It differs from *rotundicornis* Fairmaire, the only species of the genus that has been described, in the shape and direction of the suprahumerals, their summits, length of the posterior process compared with the tegmina, and the size.

SUNDARION Kirkaldy

flava Germar. Rio Grande do Sul, Brazil; Paraguay.
apicalis Germar. Rio Grande do Sul, Brazil.

HEMIKYPTHA Kirkaldy

scutelligera Lesson. Rio de Janeiro, Brazil.

Heteronotini

OMOLON Walker

tridens Walker. Iguapé, Brazil.

HETERONOTUS Laporte

delineatus Walker. Assu, Brazil.
horridus Fabricius. Pachitea, Peru.
stipatus Walker. Rio Grande do Sul, Brazil.
flavolineatus Laporte. Espirito Santo, Rio Grande do Sul, Brazil.
nodosus Germar. Pachitea, Peru; Santarem, Brazil.
spinosus Laporte. Bartica, British Guiana; Santarem, Brazil.

SMILIINÆ

Ceresini

POPPEA Stal

rectispina Fairmaire. Peru.
subrugosa Fowler. Peru.
discrepans Goding, (type). Callanga, Peru.

Poppea bulbidorsa, new species

The head is black, uneven, the base straight; the ocelli are pale yellow, large, equidistant; the lateral margins are sinuate, elevated, deeply impressed within; the clypeus is long, strongly recurved, and extended far below the middle of the apical margin.

The pronotum is luteous with a broad black stripe on each side united at the bases, extended to and reunited on the dorsal bulb; the dorsal spines are sinuate within the black stripes, long, slender, oblique, recurved and black, their posterior surface testaceous; the humerals are prominent, acute; the base of the posterior process is strongly constricted, with a globular node on the middle of the dorsum and a smaller nodule on each side touching it below and behind on the lateral margin; it is constricted behind the dorsal bulb, testaceous, ending in a small flat trifurcate process which is not bulbous and from which are emitted three spines, a terminal spine which is long, slender, and black, with the apical half ferruginous and reaching to the apex of the fourth apical cell of the corium; the lateral spines are thick at the bases but not bulbous, gradually acuminate from the middle, their bases elevated to form a distinct notch between; the dorsum of the pronotum seen from the side is deeply sulcate before and behind the dorsal bulb.

The tegmina are long, broad, vitreous, tinted with yellow, the interior basal cell ovate; the corium has three discoidal cells and five apical cells, the base of the third cell stylate; the venation is similar to that of the genua *Ceresa*.

The chest is testaceous, the abdomen orange-yellow with the apical third black; the legs are testaceous, tips of the tibiæ black, of the tarsi fuscous.

TYPE.—Female; long. cum teg. 8 mm.; lat. 2.5 mm. From Peru.

This unique example has a superficial resemblance to figure 3 on plate XXXIV in Buckton's 'Monograph of the Membracidæ,' representing *Poppea capricornis* Fowler, but differs from it in the more slender dorsal spines, the black stripes on the pronotum, and the color of the body. It is totally different from Fowler's figure of the same species.

CYPHONIA Laporte

trifida Fabricius. Rio Janeiro, Chapada, Brazil; Peru.
clavata Fabricius. Chapada, Corumba, Assu, Brazil; Bartica, Tumatumari, Kangaruma, Tukeit, British Guiana; Callanga, Peru; Paramaribo, Dutch Guiana; Amapala, Honduras.
braccata Germar. Chapada, Rio Grande do Sul, Brazil.
flava Burmeister. Chapada, Brazil.
clavigera Fabricius.
fuscata Buckton. Santarem, Brazil; Peru.

ANTONÆ Stal

guttipes Walker. Bolivia.
nodosa Fabricius. Mapiri, Bolivia; Tena, Ecuador.
tigrina Fairmaire. Bolivia.

MELUSINA Stal

exaltata Fabricius.

CENTROGONIA Stal

nasuta Stal. Chapada, Corumba, Brazil.
elegans Fowler. Chapada, Brazil.
centrotoides Walker. Chapada, Corumba, Brazil.

Centrogonia speciosa, new species

Testaceous, suprahumerals and apical half of posterior process reddish brown, tegmina with a brown apical spot. The head is twice as broad as long, uneven, the base sinuate; the ocelli are slightly approaching each other; the apical margin is broadly rounded from the eyes and impressed within, the clypeus is extended one-third below it, the apex truncate.

The pronotum is testaceous, closely punctate, dull; the metopidium is erect, its summit convex, the humerals not prominent; the suprahumerals are long, broad, slightly narrowed to the abruptly acute summits, reddish brown with black tips; they are directed outward, slightly upward at the bases and concave between, the apical half horizontal; the dorsum of the posterior process is flat, not elevated, rounded from the base, the apical half and sometimes the median carina reddish brown, subulate, and slightly longer than the abdomen.

The tegmina are colorless hyaline, the veins pale with the costa darker, and a large brown apical spot; the venation the same as in other members of the genus. The wings have four apical cells, the second cell stylate.

The body is gray or testaceous, tips of the tibiæ and of the tarsi darker.

TYPE.—Female; long. 7 mm.; lat. 3 mm. There are five paratypes which are similar. From Rio Grande do Sul, Rio Janeiro, and Corumba, Brazil.

It is distinguished by its broad flat suprahumerals.

CERESA Amyot and Serville

subfusca Buckton. Corumba, Brazil.
nigrovittata Fowler, (? variety). Chapada, Brazil.
discolor Fairmaire. Peru.
nigricornis Fowler.
axillaris Germar. Chapada, Assu, Brazil; Bolivia; Callanga, Peru.
brunnicornis Germar. Guadalupe, Mexico.
concinna Fowler. Assu, Brazil; Bartica, British Guiana; Peru; Chiapas, Mexico.
malina Germar. Rio Grande do Sul, Brazil.
affinis Fairmaire, (? new species). Mapiri, Bolivia; Sicuani, Peru.
alta Walker. Assu, Brazil; Matamoros, Mexico.
terminalis Walker. Chiriqui, Panama; Argentina; Bolivia.
vitulus Fabricius. Assu, Corumba, Chapada, Rio de Janeiro, Brazil; Callanga, Peru; Mapiri, Bolivia; Tumatumari, Chenapowu, British Guiana.
sallei Stal. Assu, Corumba, Chapada, Brazil; Surinam, Dutch Guiana; Bolivia.
testacea Fairmaire.

STICTOCEPHALA Stal

rotundata Stal. Matamoros, Cuautla, Mexico. (Rarely the posterior tip and chest are piceous.)
dubia Fowler. Costella, Republic Honduras.

STICTOLOBUS Metcalf

erectus Funkhouser. Chapada, Brazil; Bartica, British Guiana.

Amastrisini

AMASTRIS Stal

elevata Funkhouser. Peru.
flavifolia Stoll. Assu, Brazil.
fallax Stal. Chapada, Brazil.
maculata Funkhouser.
brunneipennis Funkhouser. Chapada, Brazil.
simillima Stal. Chapada, Brazil.

TYNELIA Stal

pubescens Fabricius, (typical and black variety). Kamakusa, Bartica, British Guiana.
prominens Walker. Chapada, Brazil.

Polyglyptini

PUBLILIA Stal

concava Say. Matamoros, Cuautla, Mexico.

POLYGLYPTA Burmeister

costata Burmeister (typical). Zamora, Ecuador; Pacaca, Costa Rica.
    pallipes Burmeister. Matamoros, Jojutla, Mexico.
    nigella Fairmaire. Zamora, Ecuador.
    maculata Burmeister. Pacaca, Costa Rica; Jojutla, Mexico; Mérida, Venezuela.
    viridimaculata Fairmaire. Pacaca, Costa Rica.
    dorsalis Burmeister. Matamoros, Mexico.

Smiliini

ADIPPE Stal

alliacea Germar. Rio Grande do Sul, São Paulo, Brazil.
histrio Walker. Peru; Cerro Manglaralto, Guayas, Ecuador.
zebrina Fairmaire. Pricta, Republic Honduras.

ANTIANTHE Fowler

foliacea Stal. Costa Rica.
expansa Germar. Mérida, Venezuela; Atlixco Pueblo, Pueblo Pueblo, Mexico; Pacaca, Costa Rica.
viridissima Walker. Central America.

METHEISA Fowler

lucillodes Fowler. Peru.
cucullata Buckton. Peru.

HERANICE Stal

miltoglypta Fairmaire.

POLYGLYPTODES Fowler

cornigerus Stal. Zamora, Ecuador.

HILLE Stal

erythropus Burmeister. Espirito Santo, Brazil.
herbicola Haviland, (?*altifrons* Walker). Chapada, São Paulo, Brazil.

GELASTOGONIA Kirkaldy

chrysura Fairmaire, (males black, apex white; females black and yellow). Peru.
conica Fairmaire, Baños, Ecuador.
rufipes Fairmaire, (male and female). Callanga, Peru.
gournellei Fallou, (male and female). Neguejahuira, Bolivia.
pulchella Funkhouser, (female). Callanga, Peru.
pacifica Fairmaire.

Gelastogonia gibbera, new species

Smallest of the known species, pale sordid-yellow, the dorsum bearing a high, almost semicircular, dome-like compressed elevation at the middle. The head is pale yellow, twice wider than long, punctate and carinate, the base slightly sinuate, broader with the eyes than the base of the pronotal posterior process; the ocelli are equidistant; the apical margin is sinuate, the apex of the clypeus acutely pointed.

The pronotum is densely, coarsely punctate and carinate, pale yellow with a large obscure area anteriorly; the metopidium is convex to behind the humerals, then abruptly elevated in a high, compressed, semicircular crest nearly as high as from its base to the lateral margins and slightly longer than high; the front margin of the dorsal crest is almost perpendicular, posteriorly being slightly oblique and abruptly ending at the dorsum, its sides carinate; the humerals are large, subauriculate, concolorous; the posterior process is straight to the apex and as long as the tegmina.

The tegmina are long, narrow, the apices acutely angulate and hyaline, the exterior basal half concolorous, opaque and punctate; the venation is as in other members of the genus, with no discoidal cell.

The body and legs are concolorous, tips of the tarsi piceous.

TYPE.—Female; long. 5.5 mm.; lat. 2.5 mm. From Ecuador.

The high almost semicircular crest on the dorsum of the posterior pronotal process will easily distinguish it from its congeners.

ECUADORIA Goding

fowleri Funkhouser. Callanga, Peru.

MATURNA Stal

mixta Stal. Zamora, Ecuador.
subcristata Stal. Zamora, Ecuador.

Telamonini

TELAMONA Fitch

Telamona celsa, new species

The head is yellow, twice wider than long, broad as the base of the posterior pronotal process, and the base strongly sinuate; the ocelli are much nearer to each other than to the eyes; the apical margin is rounded to the clypeus which is hirsute and extended one-half below, its tip rounded.

The pronotum is convex from the base to behind the humerals, then elevated into a crest whose front margin is straight and vertical, the summit sharply rounded and slightly decreasing in altitude to its obtuse hind angle, its hind margin obliquely sinuate and passing into the dorsum of the posterior process; the posterior process is straight, with a strong circular impression on each side at the base of the crest, its apex reaching the apex of the third apical cell of the corium; the humerals are auricular, large, with tips black. The pronotum is strongly punctured, carinate, yellow anteriorly becoming gradually darker toward the posterior apex; the median carina is yellow, fuscate anteriorly, black on the summit of the crest and apical area of the posterior process with a broad white stripe or elongate spot between; the lateral margins are narrowly black.

The tegmina are hyaline, the basal third black-punctured, but not opaque, the venation as in other members of the genus, the apical veins pale but darker toward the tips, and a large brown apical spot. The wings have four apical cells, the second cell sessile, its base truncate.

The body is sordid yellow, the ovipositor piceous, the legs testaceous, and tips of the tarsi black.

TYPE.—Female; long. cum teg. 9 mm.; lat. 5 mm. From Brazil.

This species resembles in form the figure of *Telamona ampelopsidis* Harris, on Emmon's plate III, figure 9, but is not at all like Fairmaire's figure 13 of that species on plate V.

PHORMOPHORA Stal

dorsata Fabricius. Rio de Janeiro, Brazil; Tena, Ecuador.

ACUTALIS Fairmaire

nigrinervis Fowler. Callanga, Peru.

MICRUTALIS Fowler

tripunctata Fairmaire. Peru.
balteata Fairmaire, (small). Peru.
binaria Fairmaire. Chapada, Rio Grande do Sul, Brazil.

Micrutalis atrovena, new species

The head is black with a transverse white band.

The pronotum is black, with a short curved vitta each side from and including the humerals, and subapical band, yellow.

The tegmina are pale yellow hyaline, the veins and a transverse vitta extending from the apex of the clavus to the costa, piceous.

The chest, abdomen and legs are piceous, the knees and tarsi pale yellow.

Type.—Female; long. 3.5 mm.; lat. 2 mm. There are six paratypes, all similar, from Pacaca, Costa Rica, Central America.

Micrutalis callangensis, new species

The head is black with a transverse central band and clypeus yellow.

The pronotum is black, shining, with a yellow stripe extending from the front angles each side passing on the humerals and within the lateral margins, curving to unite on the middle of the dorsum.

The tegmina are pale yellow hyaline, the claval margin and basal half of the costal margin narrowly piceous.

The chest is black, the abdomen yellow, its apex black, the femora black posteriorly, the tibiæ yellow, the tarsi fuscous.

Type.—Female; long. 4 mm.; lat. 1.5 mm. From Callanga, Peru.

Micrutalis lata, new species

The head is yellow, its base black.

The pronotum is black, shining, the lateral margins in front of the humerals yellow; the posterior process from behind the humerals broadly reddish which does not touch the lateral margins or the apex, sometimes reduced to a large reddish spot on the middle of the dorsum and gradually fading out.

The tegmina are yellow hyaline, the basal half of the claval margin and the costal margin entirely piceous.

The chest is black, the abdomen yellow, its tip black, the legs fuscous yellow.

Type.—Female; long. 5 mm.; lat. 2.5 mm. There is one female paratype which is similar, the rufous area being reduced. From Peru.

Micrutalis tartaredoides, new species

Similar to *Micrutalis tartarea* Say. The head is black, its apical margin testaceous.

The pronotum is black, shining, the lateral margins in front of the humerals with a vitta briefly and narrowly curved upward on each side, and the posterior apex, yellow.

The tegmina are colorless hyaline, with a spot on the base and the middle third piceous.

The chest and abdomen are black, the tip of the latter yellow; the legs are yellow, the femora marked with piceous.

Type.—Female; long. 3 mm.; lat. 2.25 mm. The one paratype is similar. From Bolivia.

Very closely related to *tartarea* and *moesta*, and may be identical.

Micrutalis chapadensis, new species

The head is yellow. The pronotum is yellow with a large spot occupying the disk, and tip of the apex, piceous. Spots on the chest, and margins of the abdominal segments, piceous. The tegmina are colorless hyaline, with a transverse band extended from the apex of the clavus to the costa, and apical margin of the first apical cell, piceous.

TYPE.—Female; long. 3.5 mm.; lat. 1.25 mm. One similar female paratype. From Chapada, Brazil.

Micrutalis tau, new species

The head is yellow, the base and a transverse band black.

The dorsum of the pronotum is testaceous; the basal and lateral margins, including the tip, and a reversed T-mark above the base of the metopidium whose stem rests on the median carina to the middle of the dorsum, black; there is a nearly white subapical band on the posterior process.

The tegmina are pale-yellow hyaline.

The chest and femora are black.

TYPE.—Female; long. 3.5 mm.; lat. 2 mm. From Callanga, Peru.

TRAGOPINÆ

Horiolini

HORIOLA Fairmaire

picta Stoll. Bolivia; Peru; British Guiana.
ferruginea Fairmaire. Bolivia.

Tragopini

Tragopa

cimicoides Fabricius. Pachitea, Peru.
ænea Perty. Bolivia.
punctatissima Fairmaire. Bolivia.
dohrni Fairmaire.
tetyrides Walker. Mapiri, Bolivia.
humeralis Fairmaire.
decorata Funkhouser.
albifascia Funkhouser.
luteomaculata Funkhouser. Peru.
brunneomaculata Funkhouser. Bolivia.
maculidorsa Funkhouser. Mapiri, Bolivia.
gilviceps Stal. Peru.

OLD-WORLD MEMBRACIDÆ

ÆTHALIONINÆ

Æthalionini

Darthula hardwicki Gray. Sikhim, India.

CENTROTINÆ

Gargarini

Gargara semifascia Walker. Banguey, Borneo.
Gargara pygmæa Walker. Banguey, Borneo.
Gargara luconica Fairmaire. Banguey, Borneo.
Gargara consocio Walker. Banguey, Borneo.
Gargara genistæ Fabricius. Europe.
Gargara citrea Distant. Banguey, Borneo.
Gargara pulchripennis Stal. Banguey, Borneo.
Gargara nitidipennis Funkhouser. Banguey, Borneo.

Gargara discrepans, new species

The head is as long as broad, piceous, striated, the base nearly straight; the ocelli are nearer to and slightly above the center of the eyes; the lateral margins are sinuate, the clypeus large and extended one-half its length below.

The pronotum is piceous, punctate, convex, the humerals not prominent; the posterior process is rather slender, much shorter than the abdomen, with a strong median carina which is not extended on the pronotum.

The tegmina are twice longer than broad, the margins parallel, with the acute tips at the middle of the apical margin; they are dark yellow, the veins testaceous, the basal fourth piceous, a small spot on the first apical cell and the apical margin abruptly colorless hyaline.

The body beneath is piceous, the front and middle legs, except the testaceous tips of the tibiæ and the tarsi, are piceous, the hind femora piceous with the tibiæ and tarsi testaceous.

TYPE.—Female; long. cum teg. 2.5 mm.; lat. 1 mm. From Banguey, Borneo.

This very small piceous species is distinguished from its congeners by the tricolored tegmina.

Centrotini

Anchon nodicornis Germar. Africa.
Tricoceps brunnipennis Germar. Natal, Africa.
Centrotus cornutus Linnæus. Austria, in Europe.
Tricentrus attenuatus Funkhouser. Banguey, Borneo.
Tricentrus fairmairei Stal. Banguey, Kinabalu, Borneo.
Tricentrus pilinervis Funkhouser. Banguey, Borneo; Perak, Straits Settlements, East Indies.

Tricentrus plicatus Funkhouser. Banguey, Kinabulu, Borneo.
Tricentrus calignosus Walker. Kinabulu, Borneo.
Tricentrus brevis Funkhouser. Banguey, Borneo.
Tricentrus bangueyensis Funkhouser. Perak, Straits Settlements.

Uroxiphini

Terentius conterminus Walker. Dutch New Guinea.
Terentius convexus Stal. New South Wales, Australia.
Terentius densus Walker. Dutch New Guinea.
Dinkana densus Walker. Dutch New Guinea.

Leptocentrini

Leptocentrus taurus Fabricius. Batavia, Java, East Indies.
Leptocentrus leucaspis Walker. Sumbawa Island, Dutch East Indies.
Leptobelus metuenda Walker. (*Micreune macularum* Buckton.)
Otinotus nigrorufus Distant. Victoria, Cameroons, Africa.
Otinotus recurvus Distant.
Centrotypus flexuosus Fabricius. Sikhim, India; Soekaranda, Sumatra.
Centrotypus latimargo Walker. Kinabalu, Borneo.
Centrotypus assamensis Fairmaire.
Sextius virescens Fairmaire. New South Wales, Australia.
Sextius atromaculatus Distant. Cooktown, Queensland, Australia.
Telingana paria Fairmaire. British India.

Pogon flavescens, new species

Pale sordid yellow, with a spot on the head and one on the base of the metopidium piceous, the chest and ovipositor ferruginous.

The head is elliptical, testaceous yellow, finely punctate, and pubescent, a piceous spot on the middle, the base strongly arched, the eyes gray; the ocelli are small, white, shining, equidistant and slightly above the center of the eyes with a smooth tubercle above each; the lateral margins are straight, the clypeus double longer than broad, smooth, lightly convex, with a white point on the middle, and the apex obtuse.

The pronotum is pale sordid yellow, slightly pubescent; the metopidium is perpendicular, its summit convex, a piceous spot at the base; the median carina is strong, percurrent, the humerals not prominent; the suprahumerals are widely separated at their bases, short, robust, oblique, triquetrous, tips acute, and brown beneath, the color extended briefly on the carinæ; the posterior process is strong, tectiform, with numerous smooth, irregular, pale, elevated lines which are extended on the dorsum between and upon the suprahumerals; it is gradually narrowed, the apical area slender, strongly decurved, acute, reaching the apex of the fifth apical cell of the corium; seen from the side the dorsum is distinctly convex but not strongly elevated.

The tegmina are twice longer than broad with parallel margins, pale yellow hyaline, the veins concolorous; the clavus is not acuminate, the base punctate and opaque, with two veins, the exterior one not reaching the obtuse apex; in the corium the costal and radial cells are opaque and punctate, there are two discoidal cells and five apical cells, the veins between them strongly curved inwardly; the apical margin is rounded, the limbus very narrow. The wings have four apical cells, their bases truncate.

The body beneath and legs concolorous, the chest and ovipositor ferruginous; the tibiæ are hairy, the tarsi tips piceous.

TYPE.—Female; long. cum. teg. 5 mm.; lat. int. hum. 2.5 mm.; lat. int. corn. 2.5 mm. From New South Wales, Australia.

It differs from the known species by the pale yellow color and the convex dorsum.

Hypsauchenini

Hybandoides horozontalis Distant. Kinabalu, Borneo.
Hypsauchenia hardwicki Kirby. Sikhim, India.
Pyrgauchenia jugulata Buckton.
Pyrgauchenia kinabalensis Breddin. Kinabalu, Borneo.

Pyrgauchenia cornuta, new species

Immaculate pale stramineous. The head is twice longer than broad between the eyes, the base arched with two short conical tubercles and a short median carina between them; the lateral margins are narrowed to the bluntly rounded apex.

The pronotum is punctured, and seen from the front is elevated above the head in an erect slender process; the median carina is percurrent, the lateral carina extended from each eye to the summit; seen from the side the front process is broad at the base and slightly narrowed toward the summit where there is a slender process just below the summit posteriorly, its tip expanded in a small horizontal plate, its hind margin emarginate; the posterior process is very narrow at the base, the dorsum strongly semicircularly elevated before the apex, the apical area short and slender just passing the apex of the clavus.

The tegmina are concolorous, opaque, punctate, long, and narrow, the apical margin rounded with the exterior angle subacute; the venation is almost obsolete except on the apical fourth.

The sides of the chest armed with a tooth; the body and legs are concolorous.

TYPE.—Male; long. pron. 4 mm.; cum teg. 6 mm.; alt. corn. 3 mm. One paratype similar to the type. From Banguey, Borneo.

Euxiphopœus nodosus, new genus[1] and species

Dull black, hairy, with a large anterior process at the basal angle of the posterior pronotal process, and the tegmina dark brown, the venation black.

The head is black, broader than long, finely punctate and striated, and pilose; the base is arched, the eyes brown; the ocelli are large, shining pale yellow, slightly nearer to and above the center of the eyes; the lateral margins are sinuate; the clypeus, long as broad, is extended one-half below the apical margin, its apex obtusely pointed and strongly incurved.

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[1] To be described later, in the tribe Centrotini.

The pronotum is dull black, covered with long white hairs, densely punctured, and vertically elevated above the head; the median carina is extended to the bases of the suprahumerals; seen from the front the sides are narrowed upward; the humerals are not prominent; the suprahumerals seen from the front are very long, slender, the bases almost contiguous, triquetrous, with the posterior lateral carinæ extended each side to the posterior angles on the lateral margins; they are curved upward, outward and backward, the apical fourth triangularly dilated and abruptly bent horizontally outward and gradually acuminate, the upper surface reticulate; the hind margin above the scutellum is truncate, the posterior process arises midway between the bases of the suprahumerals and the truncated hind margin, is almost vertical for a space, then abruptly bent in a right angle which anteriorly is extended forward in a short, strong, curved tooth, and continued backward and obliquely downward to the tips of the tegmina in an almost straight, slender, triquetrous carinate spine.

The scutellum is much longer than broad, black, punctate, hirsute, with the apex narrowly obtuse.

The tegmina are long, rather narrow, punctured, dark brown, the bases and venation black; the clavus has two veins, the exterior vein reaching nearly to the obtuse apex; the costa is nearly straight, the apical margin oblique with a moderate limbus, the exterior angle acute; there are two rather small subequal discoidal cells, and five apical cells. The wings have three apical cells, their bases truncate.

The body beneath is black, tomentose, the legs piceous, the tarsi and beak ferruginous.

TYPE.—Female; long. cum teg. 9 mm.; lat. int. hum. 3 mm.; lat. inter. ap. corn. 8 mm. The female cotype is similar. The habitat is given as "Dar." doubtless in central Sudan, Africa, as they were included in a lot received from that country.

MEMBRACINÆ

Oxyrhachisini

Oxyrhachis tarandus Fabricius. Egypt.

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FOUR NEW DIPTERA FROM AUSTRALIA

BY C. H. CURRAN

Descriptions of four new species of flies from Australia are presented herewith. The Rutiliæ have been segregated as undescribed for several years but the opportunity of preparing the diagnoses has not presented itself until now. The types of the new species are in The American Museum of Natural History.

CHLOROPIDÆ

While in Australia in 1928, Professor T. D. A. Cockerell, in company with Mr. Rayment, collected a small fly which was associated with a species of *Halictus*. The insect proves to be an undescribed species belonging to the genus *Ephydroscinis* Malloch, erected in 1924.

Ephydroscinis raymenti, new species

Differs from *australis* Malloch in having a large, rectangular brown spot on the middle of the wing, blackish antennæ, etc. Length, 2.25 mm.

FEMALE.—Face and anterior half of cheeks yellow in ground color, thickly whitish pollinose, the cheeks with a row of black bristly hairs. Occiput black, densely cinereous white pollinose. Front blackish, broadly reddish in front and with the middle of the triangle reddish; the triangle bears brownish-red pollen which leaves the broad lateral borders and a spot enclosing the ocellar triangle black, the ocellar triangle itself brownish pollinose. Frontal triangle with two pairs of bristly hairs anteriorly; three pairs of orbitals; ocellars long and divergent. Antennæ blackish. Palpi pale yellow.

Mesonotum rather shining brown, in the middle in front of the suture with a rectangular cinereous spot which is narrowly divided by a brown vitta; posteriorly broadly cinereous with a posteriorly tapering median brown vitta, the cinereous color extending broadly onto the sides of the scutellum; humeri and pleura cinereous white; notopleura brownish yellow. Four pairs of dorsocentral bristles, one in front of the suture. Scutellum with two pairs of marginal bristles.

Legs long, black, thinly cinereous pollinose; tarsi brown; coxæ densely cinereous white pollinose.

Wings tinged with brown, the median brown spot extending from the costa almost to the fifth vein, the portion in the apex of the discal cell isolated, leaving the posterior cross-vein bordered with subhyaline; veins dark brown; alula milky white, large. Squamæ yellowish. Halteres with whitish-yellow knob

Abdomen shining brown, the basal two segments thickly gray pollinose, the tip of the fifth segment and upper border of the two following (ovipositoral) segments, pale yellow. Hair black and inconspicuous except on the posterior of the segments toward the sides where there are some very weak bristles. Sternites thinly gray pollinose.

HOLOTYPE.—Female, Sandringham, Victoria, Australia, (Rayment and Cockerell), found with *Halictus raymenti* Cockerell, visiting its burrows on the high ground near the sea.

TACHINIDÆ

Rutilia pallens, new species

Related to *formosa* Desvoidy, but the legs are reddish, the wings lack the brown sub-basal spot, etc. Length, 13 mm.

MALE.—Head reddish yellow; occiput bright green, cinereous pollinose, the cheeks with green reflections; face and sides of front with cinereous yellow pollen; front brownish at the vertex, at its narrowest point not wider than the distance separating the posterior ocelli; frontal vitta reddish, ferruginous on upper half. Frontal pile and the occipital cilia black, the pile of the face, cheeks and occiput yellow. Facial carina very broad; antennæ separated by a distance about equal to the length of the second antennal segment; third antennal segment orange; arista brown, pubescent. The distance from the tip of the antennæ to the oral margin is greater than the antennal length. Palpi reddish yellow, yellow pilose.

Thorax light green; pale yellow pilose; mesonotum behind the suture black pilose except in the middle and without distinct vittæ. Scutellum obscure reddish beneath the green color; hair black; the sides below the bristles yellow pilose. Acrosticals, 2–2; dorsocentrals, 2–4; sternopleurals, 1–1; four pairs of marginal scutellars, the apical pair cruciate, and a row of finer submarginals. Prosternum entirely bare.

Legs reddish; black-haired, the basal two-thirds of the posterior surface of the femora with yellow pile.

Wings cinereous hyaline; pale orange basally and along the veins on the basal half. Squamæ and the pile on their inner edge pale orange.

Abdomen translucent reddish yellow with green reflections and a rather narrow median green vitta which widens basally. First and second segments without bristles, third with marginal row, the fourth with fine bristles on the apical half and not at all emarginate apically. Hair black, fine and yellow on the venter, except laterally. Genitalia brownish red; lobes of fifth sternite black.

HOLOTYPE.—Male, New South Wales, (Williston Collection).

Rutilia formosina, new species

Differs from *formosa* Desvoidy in having black pile on the pleura and prosternum and from *imperialis* Guérin in having yellow pile on the parafacials and cheeks. Length, 4 mm.

MALE.—Head pale orange; occiput green, thickly white pollinose along the orbits, the cheeks with green tinge and thinner whitish pollen. Front fully twice the width of ocellar triangle, black pilose, the bristles fine and obsolete above; parafrontals green on upper fifth. Pile of face, cheeks and occiput yellow; occipital cilia black. Antennæ little more than one-third as long as the face, separated from each other by more than the length of the third segment; arista reddish brown. Palpi reddish, black-haired.

Thorax bright green, the mesonotum with four slender, abbreviated, blackish vittæ, the outer pair interrupted at the suture; inside the humeri a large, thinly white pollinose spot visible from posterior view. Pile brown; black on the prosternum and scutellum. Acrosticals, 0–1; dorsocentrals, 0–2; sternopleurals, 0–1. Four pairs of marginal scutellars, the apical pair decussate, and two or three submarginals on either side.

Legs black or brown, black pilose; posterior tibiæ evenly ciliate.

Wings cinereous hyaline, with the usual sub-basal spot and base of costal cell brown Squamæ brownish gray, the squamal ridge brown pilose.

Abdomen bright green, a narrow median vitta blackish; a narrow apical fascia on the first segment and about the apical fourth of the second and third, bronze-brown. Basal segments without bristles; third with row of short, rather stout, erect apicals, the fourth with fine bristle-like hair. Venter wholly black-haired.

HOLOTYPE.—Male, Australia.

Rutilia corona, new species

Differs from *formosa* Desvoidy in the yellow pilose cheeks, wholly reddish antennæ, etc. Length, 13 to 14 mm.

MALE.—Head reddish yellow in ground color, the occiput green above the lower level of the eyes; pollen ochreous yellow, on the occiput grayish, Hair black, yellow on the cheeks and sometimes on most of the parafacials. Frontal and vertical bristles weak; occipital cilia black, the pile bright reddish yellow Cheeks without metallic green reflections. Palpi pale orange; proboscis black. Antennæ pale orange, not extending half-way to the oral margin; third segment twice as long as the second; arista brown. Frontal vitta dull orange; no ocellar bristles. The parafacials are wholly haired.

Thorax bright blue-green, with violaceous reflections in some lights; mesonotum with four cupreous vittæ bordered with violaceous, none of them reaching the posterior border, the median pair sometimes united for most of their length. Pile abundant, brownish, on the pleura and scutellum, black. A single pair of weak, prescutellar acrosticals and two or three pairs of weak dorsocentrals on the posterior fifth of the mesonotum; five or six pairs of marginal scutellars, the apical pair more or less cruciate; a single sternopleural. Prosternum with black hair on the sides.

Legs brown or black, the femora basally and the anterior coxæ, reddish brown; hair black.

Wings cinereous hyaline, with sub-basal brown spot. Squamæ whitish. Knobs of halteres brown.

Abdomen bright green to coppery green, with a narrow median vitta and apical two-fifths of the third segment blackish; posterior borders of first and second segments broadly cupreous. Fourth segment gently emarginate at the apex. Hair black, appressed on basal three segments; first and second segments without bristles, the third and fourth each with a row of fine marginals, the fourth with scattered, very fine discals.

TYPES.—Holotype, male, and two male paratypes, New South Wales, from the Henry Edwards Collection.

The species of *Rutilia* related to *formosa* may be separated by the key which follows. All but *pallens* have the prosternum haired laterally.

1. Pleura and prosternum with black hair.................................... 2.
   Pleura and prosternum with yellow pile, or bare.............................. 4.
2. Parafacials and cheeks with black pile.................. *imperialis* Guérin.
   Cheeks, and usually the parafacials, yellow pilose.......................... 3.
3. Pile of parafacials rather long and coarse, and usually mostly black.
   corona Curran.
   Pile of parafacials short and fine, yellowish in color........ *formosina* Curran.
4. Legs black; wings with brown spot basally................ *formosa* Desvoidy.
   Legs reddish yellow; wings luteous basally, without brown spot.
   pallens Curran.

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THREE NEW WEST INDIAN SARCOPHAGINÆ (DIPTERA)

By David G. Hall[1]

The three species of *Sarcophaga* herein described were collected in Cuba by Mr. D'Altai Welch and were sent to me for description by Mr. C. H. Curran of The American Museum of Natural History.

Sarcophaga setiforceps, new species

Figure 1

Male.—Front, 0.298 of head width (average of five specimens which measured, respectively, 0.320, 0.300, 0.285, 0.300, and 0.285); parafrontals and parafacials gray pollinose, the former with the usual row of minute hairs below near eye, and number of scattered hairs ascending to just below ocellars; frontal bristles about eleven, diverging sharply below to about the middle of the second antennal joint; antennæ black, second segment red, third segment about three times the length of second and reaching almost to the vibrissæ which are normal and at the oral margin; palpi yellow, proboscis black, both of usual type; bucca less than one-third the eye height; postocular bristles in two rows; numerous pale hairs around neck and below, none before the metacephalic suture. Outer verticals but slightly larger than surrounding hairs.

Thorax with the usual three to five black stripes; intermediate gray stripes and pleura with yellowish tinge; dorsocentrals, 2 to 4; acrosticals present only as prescutellars; sternopleurals usually two (a third may be present on one side, absent on the other); scutellum with two marginals, one subapical, and one apical.

Abdomen with usual gray tessellation; no median marginals; fourth segment with about sixteen marginals, posterior one-fourth red, fifth sternite red; arms widely divergent, the inside edges with a posterior pad of minute black bristles.

Hypopygium red; both segments covered with numerous black hairs; first segment with posterior row of about twelve bristles; forceps behind with a number of irregular shining black spines, a very unique and interesting condition; genitala as figured.

Wings hyaline; costal spine absent; third costal segment about equal to fifth in length; first vein bare; third with several setulæ.

Legs black; apical third of femora and tibiæ red; middle tibiæ with one anterodorsal bristle; middle and hind tibiæ with long dense villosity.

Types.—Twelve male specimens collected at Portio E'de Mora and Punta Alegre, Cuba, during the month of July, 1928, by Mr. D'Altai Welch. Holotype, male, in The American Museum of Natural History, collected July 11, 1928, at Punta Alegre, Cuba; paratypes in The American Museum of Natural History, the U. S. National Museum, and the author's collection.

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[1] Assistant Entomologist, U. S. Bureau of Entomology.

Sarcophaga currani, new species

Figure 2

MALE.—Front, 0.182 of head width (average of two specimens which measured, respectively, 0.191 and 0.173), parafrontals and parafacials silvery gray pollinose, the former with the usual row of minute hairs below near eye; frontal bristles about nine, diverging rapidly to about the middle of the second antennal joint; antennæ black, second segment reddish, third two and a half times the length of the second, and reaching three-fourths the distance to the vibrissæ which are normal and at the oral margin; palpi and proboscis black, ordinary; bucca one-fourth the eye height; one well-defined row of postocular bristles; a few pale hairs around neck and below; outer verticals not differentiated.

Thorax with the usual three to five black stripes, the intermediate gray ones tinged with yellow; dorsocentrals 2 to 3; acrosticals present only in the prescutellars; sternopleurals 3; scutellum with two marginals, one preapical and one apical.

Abdomen gray tessellated; first and second segments with lateral bristles only; third with a median marginal pair, quite depressed; fourth largely reddish, with a marginal row of about twelve bristles. Fifth sternite yellow, mostly obscured.

Wings hyaline; costal spine absent; third costal segment equal in length to fifth; first vein bare; third vein with a few setulæ.

Hypopygium yellow; first segment with about six marginal bristles; forceps yellow at base, black at tips; genital organization as in accompanying figure.

Legs black; middle tibiæ with one anterodorsal bristle; hind tibiæ without villosity.

TYPES.—Two male specimens collected July, 1928, at Portio E'de Mora, Cuba, by Mr. D'Altai Welch. Holotype in The American Museum of Natural History; paratype in the U. S. National Museum.

Sarcophaga welchi, new species

Figure 3

MALE.—Front, 0.180 of head width (average of two specimens which measured, respectively, 0.160 and 0.200); parafrontals and parafacials gray pollinose, former with the usual row of minute hairs below near the eye; frontal bristles about twelve, diverging below to about the middle of the second antennal joint; antennæ black, third joint three times the second, reaching four-fifths the distance to the vibrissæ which are normal and at the oral margin; palpi yellowish; proboscis black; both normal; bucca about one-fourth the eye height, covered with numerous black and pale hairs; one row of postocular bristles; back of head with numerous pale hairs around the middle and below; outer verticals absent.

Thorax with the usual three to five black stripes; dorsocentral bristles 2 to 4; acrosticals absent; sternopleurals 3; scutellum with three marginals and one subapical.

Abdomen gray tessellated; no median marginals; fourth segment half red, with a marginal row of about twelve bristles. Fifth sternite yellowish; arms widely divergent, tips prolonged downward into a well defined-pad.

Hypopygium red; first segment elongated slightly, with a posterior row of about six bristles; second segment with numerous short black bristles; base of forceps covered with very short black hair; genitalia as in the accompanying figure.

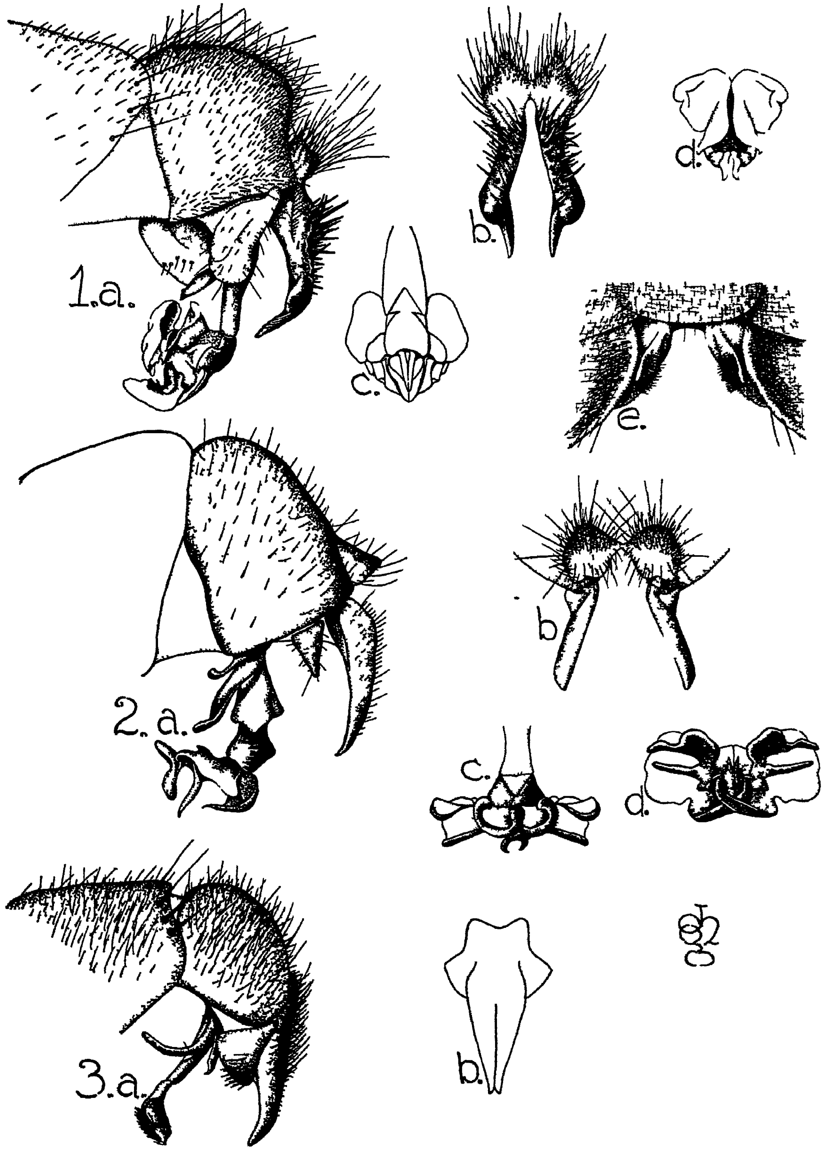

Fig. 1. *Sarcophaga setiforceps*, new species.

a, left lateral view of hypopygial composite b rear view of forceps c rear view of penis d, tip of penis e, fifth sternite

Fig 2 *Sarcophaga currani*, new species

a, left lateral view of hypopygial composite b, rear view of forceps, c, rear view of penis, d, tip of penis

Fig. 3. *Sarcophaga welchi*, new species.

a, left lateral view of hypopygial composite, b, rear view of forceps

Wings hyaline, costal spine absent, first vein bare, third costal segment equal in length to the fifth.

Legs black, apices of femora and the tibiæ red; middle tibiæ with one anterodorsal bristle; middle femur with comb; hind tibiæ without villosity.

FEMALE.—Front, 0.300 of head width in a single specimen; the usual female characteristics; legs and palpi more reddish than in male; prescutellar bristles present; middle tibiæ with two anterodorsal bristles; third abdominal segment with median marginals; genitalia dark red and rounded.

TYPES.—One male specimen collected July 11, 1928, at Punta Alegre, Cuba, by D'Altai Welch, and two specimens, a male and a female, collected December 29, 1928, at Forth Worth, Fla., by S. W. Bromley.

Holotype, male, in The American Museum of Natural History, from Punta Alegre, Cuba; allotype, female, in the U. S. National Museum, from Fort Worth, Florida.

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59.57,52 C

NEW RECORDS OF COCCIDÆ (HOMOPTERA)[1]

By T. D. A. Cockerell and Elmer D. Bueker

1.—A NEW GRASS-FEEDING COCCID FROM NEW CALEDONIA

On May 26, 1928, the senior author found a species of *Antonina* abundant on a grass which grew in the sand along the shore near Bourail, New Caledonia. It was only a short distance beyond high-water mark. The grass was without flowers or fruit and could not be identified, but it is probably an introduced species, and we may suspect the coccid of being likewise introduced. Compton (1917) says that only about six species of grasses are native in New Caledonia, and Schinz and Guillaumin (1914) list no endemic grasses.

The *Antonina*, whether indigenous or not, proves to be undescribed.

Antonina littoralis, new species

Females mostly in the sheathing bases of the leaves, enclosed in the usual dense cottony sacs, about 1.5 mm. long and 1 mm. wide, clear white, often stained with light yellow. A red color is given off on boiling in caustic potash. The female when mounted is oval in outline, 1.75 to 2 mm. long, about 1.5 mm. wide, without any projecting pygidial region. The posterior end, as usual, is brownish and more densely chitinized, with a wrinkled surface. The abdominal region, as in other species, is transversely plicate. The specific characters are as follows:

The broad, oval shape, as against the elongate form of *A. socialis* Newstead and *A. purpurea* Signoret.

Antennæ minute, two-segmented, the first joint short, the second longer than wide, with apical bristles as usual. The whole antenna is obtusely conical, not cushion-like as in *A. australis* Green.

Spiracles well developed, as usual, without distinct reticulation at base of tube; the usual group of densely packed round glands next to the orifice, these quite numerous, about 17 to 20. (About 6 to 8 in *A. panica*=*A. indica* var. *panica* Hall.)

Region adjacent to spiracles like the rest of the skin, not densely packed with minute glands as shown in Green's figure of *A. australis*.

Dermal glands small, circular, averaging about 25 microns apart. In the subcaudal region they are more numerous, forming a broad zone of densely placed glands at about the level of the anal ring.

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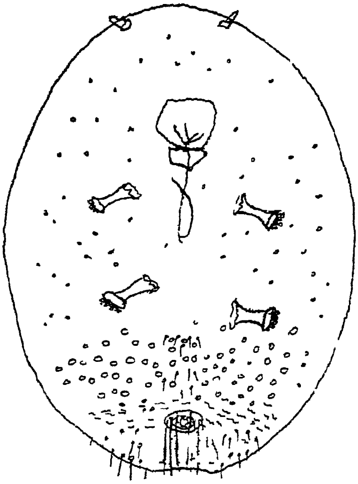
[1] The types of all species described are in The American Museum of Natural History



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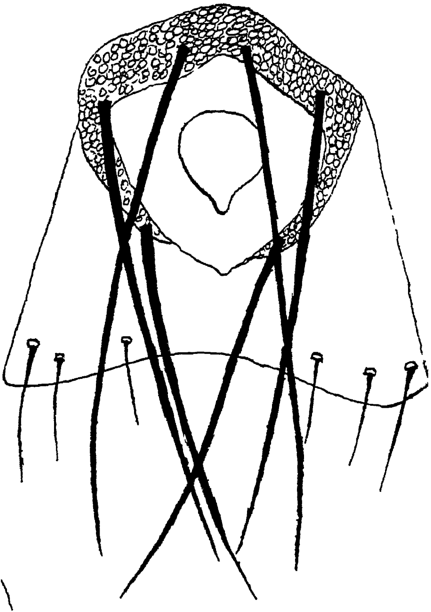

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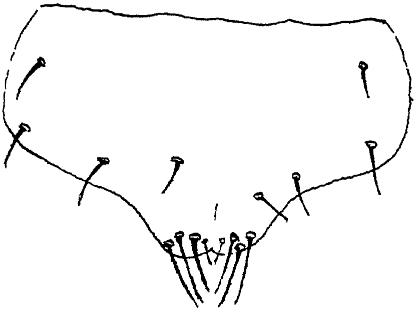

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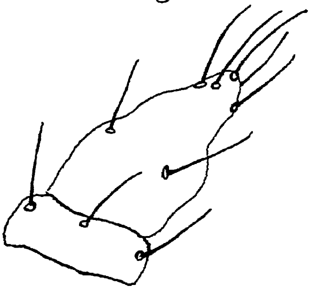

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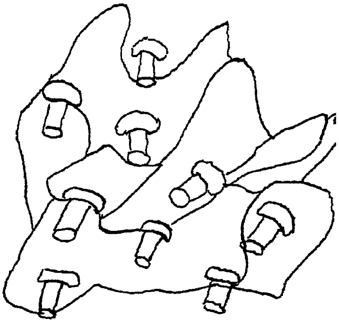

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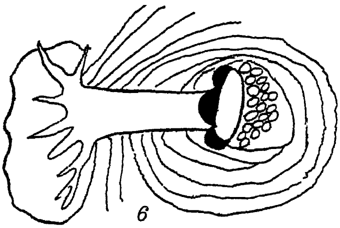
Fig. 1. *Antonina littoralis.* Adult female.
Fig. 2. *Antonina littoralis.* Anal opening with anal ring setæ.
Fig. 3. *Antonina littoralis.* Labium.
Fig. 4. *Antonina littoralis.* Antenna.

There are no distinct transverse rows of single glands, such as occur in *A. australis* and *A. panica.*

In the abdominal region are many large circular glands, showing a small central orifice, and ten spoke-like structures extending to the outer edge. These are not nearly so numerous anterior to the last pair of spiracles.

Anal ring with six bristles, as usual in the genus; but caudal region not projecting or pygidium-like, as it is in *A. australis.*

Caudal region with a sparse fringe of short bristles, about 25 microns long. These are wholly absent in *A. australis,* according to the figure; in *A. panica* they are longer and more numerous. In *A. indica* Green they are about as in our species.



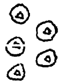


Fig. 6. *Antonina littoralis.* Anterior thoracic spiracle.
Fig. 7. *Antonina littoralis.* Ocular wax glands anterior to chitinized area.
Fig. 8. *Antonina littoralis.* Small glands near anterior end.

On the whole, our species comes nearest to *A. indica* Green. The figure shows no wrinkling at the caudal end, and the description states that the skin is slightly rugose posteriorly. In *A. littoralis* the caudal end is strongly and conspicuously wrinkled in a vermiform manner. The antennæ are very similar to those of *A. indica.* Green's figure shows 29 parastigmatic glands, our species having about 17 to 20. Hall's *A. indica* var. *panica* is still more different and must be considered a distinct species. Green describes a species (*A. maritima*) found on *Cyperus* at high-water mark in sandy soil at Colombo, Ceylon. There is no particular resemblance to the species described by Brain from South Africa.

2.—A NEW GENUS OF DIASPINÆ FROM JAVA

A very peculiar diaspine was found on *Loranthus pentandrus* Linnæus, parasitic on *Canarium* at Buitenzorg, Java, 1917 (Yaheri), and was sent in by Mr. Jas. R. Weir of Missoula, Montana. The *Canarium* is cited on the label as *C. sleeumanum,* a species unknown to us.

For some unexplained reason, *Loranthus* harbors an extraordinary number of Coccidæ. Interesting particulars and lists are given by F. Schumacher (Nat. Zeits. Forst- und Landwirtschaft, XVI, 1918, pp.

195–238) and H. Morrison (Proc. Entom. Soc. Washington, XXI, 1919, pp. 197–202). Morrison remarks that 44 species of Coccidæ have been recorded from *Loranthus*, but indicates that this means the genus in the old, broad, sense, not necessarily *Loranthus* as restricted by modern botanists. Many of these coccids, of course, are widely distributed forms, in no sense peculiar to Loranthaceæ. Such are *Pseudaonidia articulata* Morgan, *Aspidiotus hederæ* Vallot, *Chrysomphalus aurantii* Maskell, and various lecaniines. Several, however, have been found only on *Loranthus*, and some of these are quite peculiar, as for instance Morrison's *Macrocepicoccus loranthi* from British Guiana.

The insect from Java appears to form a new genus, which may be diagnosed as follows.

LORANTHASPIS, new genus

Female scale circular, with central to subcentral exuviæ, and a well-developed ventral scale; the scales are crowded on the stems, and set more or less on edge, like small bivalves. They inhabit cracks in the bark, which are filled with them. According to the old classification, based primarily on the scales, this would fall in *Aspidiotus*. In Leonardi's system (1900) it would go best in *Targionia*, though very different from the species described under that genus. In MacGillivray's classification (1921) it also falls near *Targionia*, and might seem to run to *Pygidiaspis*, which is however quite a different insect. The narrow, almost linear, median lobes are especially distinctive, and recall the immature stage of the otherwise quite different *Aonidia tentaculata* Green, 1919. There are no fringed plates or grouped glands.

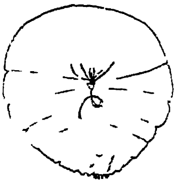
Loranthaspis microconcha, new species

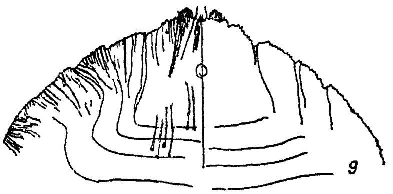
FEMALE SCALE.—Circular, highly convex dorsally and ventrally, .6–.9 mm. diameter, dark gray; first and second exuviæ central to subcentral, the first represented by an oval pellicle, 250μ long and 238 broad, light brown, the posterior end with three pairs of lobes, the dorsal side with a circular waxy secretion 126μ across. Second skin oval, 460μ long and 390 wide, dorsally with a waxy secretion. Beneath the second skin is the adult female, in a scale 900μ diameter, with well-developed ventral scale, so that it is completely enclosed (but not in the second skin as in *Aonidia*).

LARVA.—Oval, 245μ long, 210 wide; antennæ 6-segmented, length of segments in μ (1) 10, (2) 6, (3) 12, (4) 3, (5) 5, (6) 13. Middle leg: coxa 10, trochanter with femur 28, tibia 8, tarsus with claw 25μ; caudal end with three pairs of lobes, median wide at base, smooth and slightly convex at apex; second about half width of median, third slightly wider than second.

SECOND STAGE.—Oval, 490μ long, 406 wide; pygidial region continuous with margin of body, twice as wide as long; median pair of lobes minute, contiguous, spiniform, about one-third length of second lobe; second lobes with broad base and wide convex apex, notched apically on inner side and with two notches on outer; there are slight processes of the body, not chitinized, in place of second and third lobes; a single row of scattered marginal setæ; tubular wax glands numerous, laterad of the fourth rudimentary lobe; in proximity to anal opening and anterior to it are tubular glands, as figured

Adult Female.—Circular; antennal tubercles well developed, with a long slender seta at apex and two short ones at base; pygidial area three times as wide as long; median pair of lobes extremely long and narrow, with no structures between them; second pair broadly rounded, slightly wider than long, notched on inner side, and on the outer side near base; in the place of the third and fourth lobes are large broadly angular projections of the margin, with notched or irregular edges; laterad of each median lobe is a slender spine slightly longer than the second lobe; setæ few, as figured; grouped glands absent; numerous tubular glands laterad of fourth rudimentary lobe (projection), along pygidial margin.





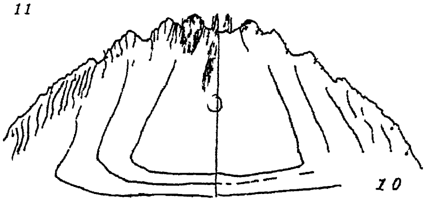


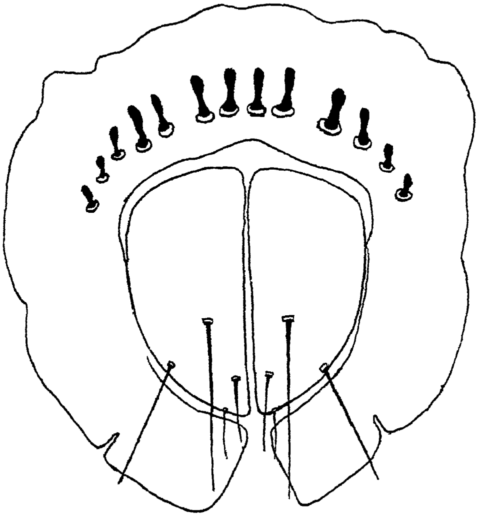
Fig 9. *Loranthaspis microconcha.* Pygidium of second nymphal female.
Fig. 10. *Loranthaspis microconcha.* Pygidium of adult female.
Fig 11. *Loranthaspis microconcha.* Outline of body of adult female.

The insect is evidently viviparous, as many as seven or eight young may be seen within the female.

3.—A NEW WAX-SCALE FROM HAITI

The wax-scales, genus *Ceroplastes*, so far as at present known, number 102 species and 10 races or varieties. The species are most abundant (41) in South America, but America north of Panama has 22, nearly all in the Neotropical portion. Africa shows 31, but Europe, Asia and the Australian region together only eight. The few species which have been spread by commerce are only counted once in this enumeration.

The new species before us was obtained by Professor H. L. Dozier on "Bois de Fourmis" (*Maytenus buxifolia* Grisebach, family Celastraceæ) at Sources Puantes, Haiti, Nov. 14, 1929. From it, he has reared



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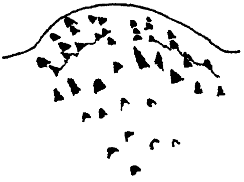

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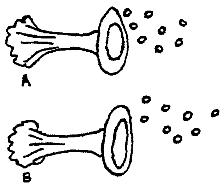

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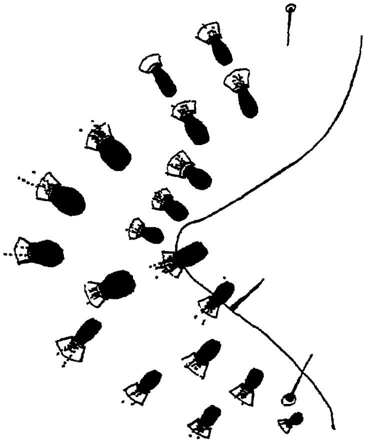

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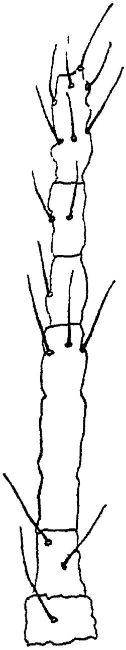

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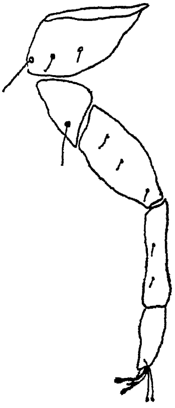

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Fig. 12. *Ceroplastes dozieri.* Anal plates.
Fig. 13. *Ceroplastes dozieri.* Spines of stigmatic depression.
Fig. 14. *Ceroplastes dozieri.* Portion of derm between sitgmatic depressions.
Fig. 15. *Ceroplastes dozieri.* Anterior (A) and posterior (B) thoracic spiracle.
Fig. 16. *Ceroplastes dozieri.* Middle leg.
Fig. 17. *Ceroplastes dozieri.* Antenna.

seven different chalcidoid parasites. The genus *Maytenus* seems to be favored by *Ceroplastes*, *C. albolineatus* Cockerell, *C. communis* Hempel, *C. formicarius* Hempel, *C. rotundus* Hempel, and *C. sanguineus* Cockerell, having been taken upon it. These are all Neotropical species, none of them at all closely resembling that from Haiti. The Haitian species, although rather commonplace in external appearance, is evidently new.

Ceroplastes dozieri, new species

Female scales on the twigs and small branches; male scales on the leaves, scattered or along the midrib beneath. Female scales of thick irregular white wax, having a slight greenish tint, but without reddish color; lines of white secretion at the sides, but no division into plates; the general form is oblong, elevated, but the wax irregularly formed and sometimes showing strong ridges. Length, about 5 mm.; width, 4. The denuded female is small, about 2.4 mm. long and 2 wide, but with the caudal horn very small and short, wherein it differs from *C. ceriferus* (Anderson), which has similar wax. The spines of the stigmatic depressions are distinctive, being short, broad, and truncate, or even slightly cupulate at apex; in the anterior depressions are about 18 or 19 of these, five larger than the rest. Anterior thoracic spiracle of ordinary form, with eight derm-pores near outer opening; posterior spiracle also with eight pores. Toward the margins are thick chitinous protuberances, varying in form, but more or less pointed; these seem to form five or six very irregular rows, except near the stigmatic depressions, where there is only one row. Antennæ with six joints, measuring in μ about (1) 24, (2) 30, (3) 88, (4) 22, (5) 25, (6) 40. Middle leg in μ: coxa 25, trochanter with femur 90, tibia 70, tarsus 37; digitules of tarsus long, slender, slightly clubbed at apex; digitules of claw slightly shorter and thicker and distinctly dilated apically. Anal plate 113μ long, 50 wide; three subapical setæ on plate, and also a small one on margin at hind end; anterior to the plates is an arched row of 12 to 14 tube-like structures.

Male scales elongate, slightly over 1 mm. long, white, with a bifid projection at each end, and three obtuse waxy projections on each side. Young female scales are short and oval, pale reddish.

4.—A NEW *LECANIINE* SUBGENUS

Marsipococcus, new subgenus

On January 19, 1928, on Pah Meeung Mountain in northern Siam, Miss Alice Mackie found male and female scales of a very interesting lecaniine coccid on leaves of an undetermined plant. The species proves to be *Lecanium marsupiale* Green, hitherto known from India and Ceylon. Under some of the male scales are perfect males, agreeing with Green's figure.

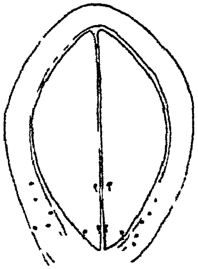

Fig. 18. *Lecanium marsupiale.* Anal lobes.

The species falls in the genus which has been well described (1929) by Steinwenden as *Coccus*, though the senior author has given reasons for considering that this name is not applicable. It nevertheless forms a very distinct section or subgenus, especially characterized (female) by the stigmatic clefts, with thickened margin, no trace of a central spine, but a structure like the end of a finger at each side. Also characteristic are the ventral pouches, which gave rise to the specific name. The antennal segments were found to measure in μ: (1) 63; (2) 42; (3) 84; (4) 56; (5) 65; (6) 35; (7) 35; (8) 58. Middle leg: coxa 140; trochanter with femur 294; tibia 154; tarsus 126. For this insect we propose the subgeneric name **Marsipococcus.**

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NEW AMERICAN ASILIDÆ (DIPTERA)

BY C. H. CURRAN

Descriptions of twenty new species of Asilidæ from Arizona, Panama, Abdomen black in ground color, brown pollinose, with broad bands of grayish pollen on the apices of the segments, the lateral margins and venter wholly gray; second segment with a gray band at the basal fourth which is produced posteriorly in the middle and sometimes is very broadly united with the posterior fascia leaving a blackish spot on either side. The pale bands are successively narrower on the segments from the base to the apex of the abdomen. Hair of the dorsum black; on the first segment, entire lateral margins of the abdomen, the venter and genitalia, pale yellowish. First segment with about five black bristles on either side.

Female.—Ovipositor short, shining black above, the apex reddish; sides broadly, and the under surface, brownish-gray pollinose.

Types.—Eight males and fifteen females, Bruja Point, Canal Zone, January 25, 1929 and ten females, Patilla Point, January 15 and February 1, 1929, (Curran). The holotype, male, and allotype, female, were taken at Bruja Point.

This species, in color and shape, bears a strong resemblance to many [illegible] species of *Asilus*, etc. I do not know of any closely related species [illegible] *Deromyia*, and cannot compare it with allied species. On [illegible] dark color it stands out by itself in the genus.

[illegible] occurs on the [illegible] along the coast [illegible]

Venter reddish on more than the basal half.............................11.
8. Wings brownish or blackish...9.
Wings hyaline...*coquilletti* Back.
9. Femora without black vitta above.......................................10.
Femora with broad black vitta above............................*dispar* Coquillett.
10. Scutellum with two bristles....................................*purus*, n. sp.
Scutellum with four bristles..................................*combustus* Loew.
11. Wings entirely hyaline..12.
Wings brown along the veins...................................*luteus* Coquillett.
12. Mesonotum gray pollinose...................................*semiustus* Coquillett.
Mesonotum yellowish-gray pollinose, with three brown vittæ.
hyalinus Coquillett.

Saropogon aridus, new species

Black, the head and thorax silvery-gray pollinose. Length, 12 mm.

MALE.—Hair and bristles of the head black; postvertical bristles pa
Second antennal segment reddish brown, enlarged apically, almost
third segment missing.
[illegible]

Thorax brownish; mesonotum with the sides and posterior border broadly reddish; pleura brownish-golden pollinose, the posterior border of the mesonotum and the scutellum with somewhat paler pollen. Hair and bristles wholly black; scutellum bare except for the single pair of black marginal bristles.

Legs dark brownish red; anterior femora except the apex, basal two-thirds of the middle pair and basal third of the posterior pair blackish; tarsi more or less darkened apically. Coxæ reddish-brown pollinose and with black bristly hairs.

Wings brown, very broadly

Antennæ black, the apical two segments reddish-brown pollinose; third segment very long, the spine situated a little beyond the apical third of the upper surface.

Thorax brownish-ochreous pollinose, the pleura somewhat paler; pile and bristles yellowish. Mesonotum with a pair of narrow, very obscure darker vittæ and a spot on either side posteriorly. Scutellum shining brown, its border gray pollinose, its disc strongly roughened.

Legs reddish; coxæ black, grayish-white pollinose and pilose; apices of tarsal segments brownish. Hair and bristles yellowish.

Wings luteous on more than the basal half except posteriorly, grayish apically. Squamæ and halteres reddish yellow.

Abdomen shining black, with moderately fine punctures; hair very short and yellowish, on the sides and venter longer and whitish. Second to sixth segments with a transversely triangular yellowish-white, pollinose spot, the sides of the first segment broadly covered with similar pollen Apical third of the sixth and the whole of the following segments reddish. Venter gray pollinose.

HOLOTYPE.—Female, Mud Springs, Santa Catalina Mts., Arizona, July 17–20, 1916, (F. E. Lutz).

DAMALIS Fabricius

Only two species of *Damalis* have been described from America: *divisus* Walker, from Brazil, and *occidentalis* Williston, from Mexico. It is not certain that *divisus* belongs to the genus so that there may be but one described species from America. During a collecting trip to Arizona in 1916, Dr. F. E. Lutz secured two males of an undescribed species and these represent the first record of the genus from the United States. The two North American species are separable as follows:

a. Middle and hind femora strongly swollen apically and bearing black hair. *occidentalis* Williston.

b. Middle and hind femora not unusually swollen apically and bearing pale yellowish hair *americanus*, n. sp.

Damalis americanus, new species

Black in ground color, the legs brownish red and reddish yellow. Length, 7.5 mm.

MALE.—Head cinereous pollinose and white pilose, the front without pile; ocellar tubercle with short yellow hair; occipital cilia not differentiated. Basal two antennal segments brownish red; third brown, elongate oval, pointed at apex; style not quite as long as antenna.

Thorax black; yellowish-gray pollinose; mesonotum with a pair of broad, widely separated dorsal vittæ and a spot on either side behind the suture. Pile pale yellowish, a broad, incomplete, medianly interrupted fascia of black pile across the posterior third of the mesonotum; posterior border of the mesonotum, scutellum wholly, upper half of metanotum and most of the pleura, with gray pollen and whitish pile. Humeri and posterior calli reddish brown.

Legs varrying from reddish brown to brownish red with extensive reddish coloration, the tarsi reddish yellow. Coxæ black, cinereous pollinose and white pilose. Pile white; yellowish on the broad apices of the femora.

Wings cinereous hyaline, a little brownish basally in front. Halteres pale yellow.

Basal three abdominal segments dull brown, gray laterally, the first with some gray pollen dorsally; apical segments gray with the apices brown in the middle. Pile whitish, brown on the second and third segments except laterally, the disc without pile. Venter gray pollinose and pale yellow pilose. Genitalia shining reddish yellow, the apex black, pile pale yellow.

TYPES.—Holotype, male, and one male paratype, Back Dyke Prospect, Sierritas, Arizona, July 26–29, 1916, (F. E. Lutz).

Bathropsis basalis, new species

Figure 1

Black only the halteres yellow; wings brownish in front to beyond the middle. Length, 6.5 to 7.5 mm.

MALE.—Face, front and the broad posterior orbits on the lower three-fourths, silvery pollinose the occiput with brownish-yellow [illegible] whitish;

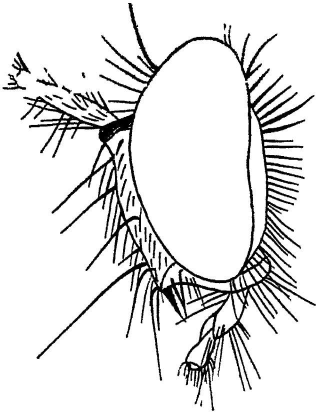

Fig. 1. *Bathropsis basalis*, new species. Profile of head.

frontal pile and bristles black, the upper occipital cilia yellow; facial bristles arranged in two rows, black in color. Antennæ shining black, black-haired; third segment brownish pollinose, without spine at apical third of upper edge; terminal segment wider than long and not well separated. Proboscis and palpi shining black.

Mesonotum and scutellum with golden, appressed, pubescent-like hair, the lateral margins with black hair; bristles black. Scutellum with about eight very fine, short, upwardly directed yellow marginal bristles. Pleura grayish-white pollinose, a large spot covering most of the mesopleura and part of the sternopleura, black; pteropleura and lateral swellings of the metapleura yellowish-brown pollinose; trichostical bristles and hair black. Metanotum with brownish pollen, and black bristly hair on the slopes. Pile of humeri and pleura pale yellow.

Coxæ grayish pollinose and whitish pilose. Legs yellowish and yellowish-white pilose, posterior femora and tibiæ dorsally, posterior tarsi wholly and the apical two or three segments of the anterior four tarsi, black-haired. Bristles yellowish, black on the posterior tibiæ and tarsi.

Wings grayish hyaline, yellowish brown on the anterior half to beyond the middle, the marginal cell hyaline basally. Squamæ pale yellow apically and with short white fringe. Halteres pale yellow.

Abdomen rather coarsely punctured, with very short, appressed hair; base and dorsum black-haired on first four segments, the sides, increasingly more widely so on each segment, golden-haired, the apical two segments without black hair. Venter brownish, dull, with fine, cinereous pile. Genitalia small. The black pile on the abdomen may be considerably reduced in extent. Bristles brownish yellow.

Female.—Differs only sexually.

Types.—Holotype, male, Barro Colorado Island, Canal Zone, February 18 1929; allotype, female, Barro Colorado, February 15, 1929. Paratypes: two males, same data as holotype and one male, Patilla Point, Canal Zone, February 1, 1929, (Curran).

I found this species only in the woods. The specimens from Barro Colorado Island were taken along streams while the specimen from Patilla Point was in a partial clearing through which a stream runs in the wet season.

The only other species included in this genus is *peruviana* Hermann. It has the wings hyaline and a spine at the apical third of the third antennal segment.

Protichisma albibarbis, new species

Differs from *longimanus* Hermann in having the face entirely white pilose, the four pairs of bristles black. Length, about 8 mm.

Female.—Head pale yellowish pollinose, the posterior orbits broadly white on the lowest three-fourths. Vertex shining brown except in the middle. Pile pale yellowish; occipital cilia black; ocellar bristles brownish yellow. Palpi and base of proboscis yellowish, the former black-haired. Antennæ black, the first segment yellow, almost as long as the third; hair and bristles black.

Thorax blackish or brownish, the mesonotum with very short, appressed golden pile. Scutellum with extremely short pale hair arising from moderately large punctures; no bristles. Pleura brownish or brownish red, thickly white pollinose, the pile white; trichostical bristles mostly black. Bristly hair on the slopes of the metanotum black.

Legs reddish or brownish yellow, the hair and bristles yellow; bristles on femora and tarsi and the hair on the upper surface of the femora and tarsi, black. Coxæ brownish; yellow pilose and whitish pollinose.

Wings cinereous hyaline, the base broadly hyaline. Squamæ with brown border and yellowish fringe. Halteres yellow.

Abdomen blackish, with appressed, very short golden-yellow hair, the fourth and fifth segments, except the broad base of the fourth, with black hair. Venter paler than the dorsum, cinereous pollinose, yellow-haired, the apical sternite with black hair.

In this genus the abdomen is clavate, the second and third segments being narrowed.

HOLOTYPE.—Female, France Field, Canal Zone, January 18, 1929, (Curran).

The specimen described above is teneral and it is not possible to be sure of the colors. The abdomen appears luteous but it would normally be blackish and the legs may normally be darker than described. The specimen was taken in mangrove swamp and inhabits trails or clearings.

EUMECOSOMA Schiner[1]

1. Legs wholly black or only the knees narrowly reddish....................2.
   At least the basal half of the anterior tibiæ yellowish....................3.
2. Face of male golden yellow above, white below; of female yellow on sides, black in middle....................metallescens Schiner.
   Face of both sexes pale yellow or whitish.......hirsutum Hermann.
3. Legs partly black....................4.
   Legs wholly yellowish....................[illegible]tica Wiedemann.
4. Anterior femora mostly yellowish....................5.
   Anterior femora practically all black..........shropshirei, n. sp.
5. Anterior four tibiæ pale or only a little darkened....................6.
   Anterior four tibiæ blackish on apical third or more.......*gibbum*, n. sp.
6. Posterior tarsi black....................*staurophora* Schiner.
   Posterior tarsi yellow....................*tarsalis*, n. sp.

Eumecosoma shropshirei, new species

Figure 2

Black, the legs partly reddish yellow. Length, 7.5 to 9 mm.

MALE.—Head golden pollinose, the vertex laterally and central part of the occiput appearing black in most lights. Bristles black; hair pale yellowish, almost white on the lower half of the occiput; bristles along the oral margin often yellowish: face swollen just above the oral margin. Palpi and proboscis black. Antennæ black, with black hair and bristles, third segment almost twice as long as the basal two combined, with an elongate-oval, grayish-white area near the lower apical edge.

Thorax with yellowish-brown pollen in front and along the very broad middle line; inside each humerus with a large, rather golden, pollinose triangle. Pile of dorsum black; sparse on the scutellum which bears a pair of black bristles. Pleura cinereous-white pollinose, with a very broad yellowish band extending from the notopleural region to the front coxæ and a brownish band from the pteropleura to the middle coxæ; metanotum brown pollinose. Mesopleura with several black bristles behind, the trichostical bristles black above, yellow below; fine hair on the pleura pale yellowish.

Coxæ black, gray pollinose and yellow pilose; anterior four trochanters and immediate bases of all the femora reddish. Femora shining black, with reddish tips. Anterior four tibiæ reddish yellow, with about the apical third blackish, the posterior

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[1] *E. dichroma* Bigot (Brazil) is not included.

pair more or less reddish at the base. Tarsi black, the immediate bases of the basal four segments of the anterior four, reddish. Hair and bristles mostly black; on the posterior surface of the anterior four tibiæ and the ventral surface of the anterior four femora, reddish yellow, the posterior femora with a few reddish bristles basally on ventral surface.

Wings cinereous hyaline, broadly darker apically. Squamæ pale brownish, with blackish fringe. Halteres yellowish.

Abdomen bronze-black, with short, appressed black hair; sides of the basal four segments with yellowish hair and fine bristles. Venter brown, thinly pollinose, yellow-haired. Genitalia small, black.

FEMALE.—Differs only sexually; abdomen more spatulate.

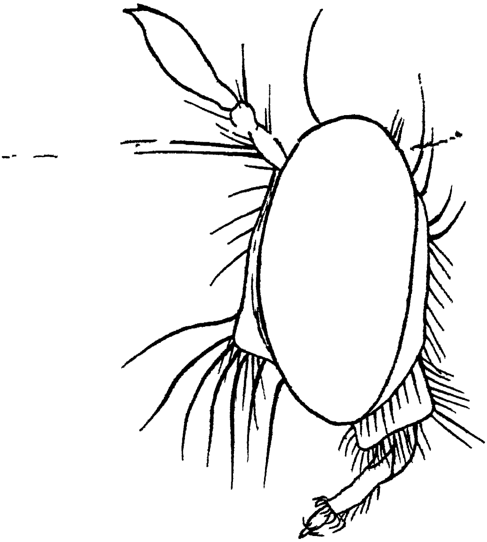

Fig. 2. *Eumecosoma shropshirei*, new species. Profile of head.

TYPES.—Nine males and five females, Canal Zone. Two males and one female, Fort Sherman, February 5, 1929; seven males and four females, Barro Colorado Island, December 22, 25, 26, 1928 and January 7 and 10, 1929, (Curran). The holotype, male, and allotype, female, were taken on December 22, 1928.

This species differs from *pleuritica* Wiedemann in having the legs largely black and from other species in having the anterior femora almost all black.

Specimens were captured only along streams, both on the Island and at Fort Davis. The insects sit on leaves of low plants in wait for prey, but I did not observe any of them feeding.

Eumecosoma gibbum, new species

Black; legs partly reddish yellow; wings infumated; mesonotum strongly convex. Length, 6 to 8 mm.

MALE.—Face and front brown pollinose but appearing dull black in some views; occiput brownish-gray pollinose, usually appearing black. Hair and bristles on lower half of the face and on the occiput, whitish; upper orbital cilia black; bristles on upper half of face and the ocellar bristles, black; front without hair. Palpi black, yellow-haired, the apical bristle black. Proboscis black, yellow-haired, with a pair of black bristles on the under surface near the middle. Antennæ black with black hair and bristles; third segment with thin brownish pollen, the brownish-gray sensory ar[illegible] the inner side occupying almost half the segment.

[illegible] metallic black, subopalescent, black-haired dorsally; strongly convex, the se[illegible] and with a strongly marked marginal groove, with scattered hair on the [illegible] eight weak marginal bristles. Pleura gray pollinose in front, brownish yellow [illegible]ddle and brown on almost the post[illegible]r half; hair and bristles yellowish, sometimes a few of the trichost[illegible] bristles black; hair on metanotal slopes black.

Coxæ and trochanters [illegible] yellow, the former pale yellow pollinose and with yellow hair. Femora [illegible] yellow on [illegible] half or more, blackish apically except the tips; anterior four tibiæ [illegible] yellow [illegible] third to three-fifths, the posterior pair with less than the basal fifth [illegible]. Hair yellow on under surface and base of the femora except ap[illegible] on ventral surface, black above except basally; posterior femora with silvery-white hair above when viewed from the base. Tibiæ black-haired, the anterior pair with reddish or pale golden pubescence below, the posterior pair with abundant, erect, rather short yellow pile. Bristles of the legs black, rather fine.

Wings infuscated, a little paler basally. Squamæ with brown fringe. Halteres reddish yellow.

Abdomen rather dull black, the segmental articulations and sides of the basal segment shining. Hair extremely short, black; on the sides longer and yellowish. Venter brown pollinose and pale yellowish pilose. Genitalia small, shining black.

FEMALE.—Face silvery or silvery white, often brownish yellow above; bristles usually black although two or three pairs near the oral margin are often yellowish or white.

TYPES.—Eighteen males and eighteen females, Barro Colorado, Canal Zone, between December 22, 1928, and February 21, 1929, (Curran), and November 11, 1923, (F. E. Lutz). The holotype, male, and allotype, female, in coitu, were taken on January 10, 1929.

This species is readily recognized by the largely black anterior tibiæ, half reddish-yellow femora, color of facial pile and shape of the thorax. It is found entirely along streams, sitting on the leaves of low plants. It was not observed feeding although was seen darting after small moths and dolichopids.

Eumecosoma tarsalis, new species

Black, the legs mostly reddish yellow; wings tinged with brown. Length, 5 to 6.5 mm.

MALE.—Face, anterior half of front and the broad posterior orbits on the lower three-fourths, white pollinose, somewhat silvery; posterior half of front and the occiput with brownish yellow, somewhat golden pollen. Hair white; occipital cilia yellowish, ocellar bristles and one or two pairs in the mystax black. Palpi black; proboscis brown or black. Antennæ black, black-haired, third segment yellowish-brown pollinose, the sensory area occupying most of the inner surface and grayish pollinose.

Mesonotum shining with greenish opalescence and brownish pile, the bristles black. Scutellum flat above, bare, with a pair of black bristles and sparse black hair on the margin. Pleura thinly brownish pollinose above and whitish below, the pile white; trichostical pile very pale yellowish.

Coxæ black, cinereous pollinose and pale yellow pilose. Femora reddish yellow, the posterior pair with a little more than the median half black. Tibiæ reddish yellow, the posterior pair black except the apices. Tarsi reddish yellow, the apical segment brown. Hair and bristles of the legs yellow, the apical bristles on the anterior and posterior femora, three long anterior bristles on the posterior four tibiæ, the dorsal hair and bristles and the anterior bristles on the anterior four tarsi, black.

Wings tinged with brown. Squamæ with yellow border and fringe. Halteres yellow.

Abdomen dull black, in some views metallic, with short black hair, the sides, apical segment and venter with pale yellow hair. Each segment with a single yellow bristle laterally, the first segment with two. Venter reddish brown or brownish red.

FEMALE.—Differs only sexually.

TYPES.—Eight males and eleven females, Barro Colorado Island, December 22, 1928, to February 18, 1929, and one male and female, Fort Sherman, Canal Zone, February 5, 1929, (Curran). The holotype, male, and allotype, female, were taken on Barro Colorado Island on January 9, 1929.

This species most closely approaches *staurophora* Schiner but is distinguished by the reddish-yellow tarsi. Its habits are the same as outlined for the preceding species.

CEROTAINIA Schiner

Four of the species contained in the Museum collection are herein described as new. The genus is known only from America.

TABLE OF SPECIES

1. Mesopleura swollen and very prominent..............................2.
   Mesopleura of ordinary form..............................6.
2. Wings with yellow tinge..............................*xanthoptera* Wiedemann.
   Wings with brown tinge..............................3.
3. Hair of anterior half of thorax extremely short and inconspicuous; legs wholly black in both sexes..............................*minima*, n. sp.
   Hair of thorax longer, very conspicuous; tibiæ of male usually yellow......4.

4. Face brownish-yellow pollinose. . . . . 5.
   Face cinereous-white pollinose. . . . . *albipilosa*, n. sp.
5. Mesonotum with brownish-golden pile. . . . . *jamaicensis* Johnson.
   Mesonotum with yellowish and black pile. . . . . *macrocera* Say.
6. Abdomen about two and a half times as long as the thorax. . . . . 7.
   Abdomen almost four times as long as the thorax, slender. . . . . . . 9.
7. Hair of thorax and abdomen pile-like and thick. . . . . 8.
   Hair extremely short and appressed. . . . . . . *bella* Schiner.
8. Basal half of wing brown. . . . . *dasythrix* Hermann.
   Wings hyaline. . . . . *leonina* Hermann.
   [illegible] antennal segment only three times as long as the second; anterior tibiæ [illegible]rsi silvery pilose. . . *argyropus* Schiner.
   [illegible]ment at least four times as long as the second. . . . . 10.
   Me[illegible]-haired. . . . . [illegible]
   Mesonotum [illegible] . . . . *unicolor* H[illegible]
   [illegible]domen with reddish-[illegible] pollen. . . . . 12.
   [illegible]ly black. . . . . 13.
12. Ocellar [illegible] with [illegible] bristl[illegible] . . . . [illegible] yellow [illegible] Arri[illegible]
   Ocellar triang[illegible] . . . . [illegible] ra Arribalzaga.
13. Wings hyaline, the ap[illegible]
   Wings hyaline or tinged with [illegible] . 14.
14. At least the anterior tibiæ very broa[illegible] . . . . 16.
   Legs black or brown, at most the knees yellow . . . . .15.
15. Antennæ black-haired . . . . *argyropyga* Hermann.
   Antennæ largely yellow-haired. . . . . *propinqua* Schiner.
16. Ground color of the abdomen concealed by silvery or golden hair. . . . . .17.
   Ground color never concealed by pale pile. . . . . .18.
17. Basal two abdominal segments densely silvery pilose; ocellar tubercle with two bristles. . . . . *argyropasta* Hermann.
   Third to fifth segments golden-yellow pilose; ocellar tubercle with four bristles. *aurata* Schiner.
18. Tibiæ and tarsi yellow; wing veins pale brown. .21.
   Tibiæ and tarsi at most brownish yellow; veins dark brown or black. . . . . .19.
19. Bristles of the posterior legs black. . . . . .20.
   Bristles of the posterior legs yellow. *debilis* Hermann.
20. Third antennal segment almost as long as the first or longer. . . . . .22.
   Third antennal segment little more than half as long as the first .*feminea*, n. sp.
21. Fine hair of face and front black. *flavipes* Hermann.
   Fine hair of face and front yellow. . . . . *willistoni*, n. sp.
22. Tarsi black; third antennal segment not longer than the first. *brasiliensis* Schiner.
   Anterior four tarsi reddish, the apical segment brown; third antennal segment one-fourth longer than the first. . . . . *willistoni*, n. sp.

Cerotainia minima, new species

Related to *macrocera* Say but the hair of the mesonotum in the male is extremely short in front and not visible in some lights. Hair of posterior half of mesonotum and scutellum appressed and silvery white; female with the black presutural band very broad and reaching the humeri or wholly without such band. Length, 4 to 5.25 mm.

MALE.—Face and front dark brown pollinose; posterior orbits very broadly gray pollinose. Hair and bristles black; pile white on lower half of occiput. Palpi with yellow hair. Proboscis and antennæ black-haired.

Thorax metallic black, the posterior half and scutellum with conspicuous silvery-white, appressed hair; anterior border and mesopleura yellow-haired; pleura white-haired and cinereous white pollinose on the lower half; mesopleura with coarse punctures, strongly swollen. Bristles on mesonotal slopes stout and black. A broad black-haired fascia in front of the suture.

Legs black; tibiæ and broad base of tarsi, brown; coxæ very thinly gray pollinose; bristles and hair of legs yellow, black on dorsal surface of femora and tibiæ.

Wings tipped with brown. Squamæ gray, with whitish fringe. Knob of halteres reddish yellow.

Abdomen black, with greenish reflections, coarsely punctured. The apices of segments shining, apical segment broadly bordered [illegible] below, the apices of the two preceding segments [illegible]. Hair extremely short black on the dorsum, white on the sides [illegible]; venter brown.

FEMALE.—Differs sexually. The black presutural band may [illegible] or almost [illegible] and there [illegible] bristles [illegible] on the abdomen [illegible] apical [illegible] pile on [illegible] half of the mesonotum and scutellum is [illegible] and not [illegible].

TYPES.—One male and ten females [illegible] Colorado Island, Canal Zone, December [illegible], 1929, and one female, Corozal, January 16, 1929, (Curran). The holotype, male, and allotype, female, are from Barro Colorado Island, January 3, 1929.

Cerotainia albipilosa, new species

Related to *macrocera* Wiedemann but the abdomen of the male bears white pile dorsally, that of the female blackish; face cinereous white pollinose. Black, the tibiæ and tarsi reddish or brownish red. Length, 7 to 8 mm.

MALE.—Head ashy-white pollinose and whitish pilose, the bristles poorly differentiated. Antennæ black, black-haired; third segment brown pollinose. Palpi black.

Thorax finely punctured, with subappressed silvery-white hair, the hair on the pleura mostly erect. Pleura and coxæ cinereous pollinose.

Legs black; tibiæ usually reddish, the posterior pair sometimes reddish brown, except at base and apex; basal three or four tarsal segments reddish. Hair white, silvery and abundant on tibiæ and tarsi. Bristles scarcely differentiated.

Wings tinged with brown. Squamal border and fringe pale yellow. Halteres reddish yellow.

Abdomen thickly punctured, the sides of the apical three segments broadly reddish. Pile white, appressed, very conspicuous in most views. Venter brownish red; brown pollinose. Genitalia reddish.

FEMALE.—Pollen and pile of head with slight yellow tinge; pile of mesonotum shorter, rather tawny. Hair of abdomen very short, black, white on the sides and venter.

TYPES.—Holotype, male, Black Mountains, North Carolina, June; allotype, female, Valley of Black Mountains, N. C., July 9, 1906, (W. Beutenmuller). Paratypes: three males and one female, Valley of Black Mts., N. C., June 24–30, July 15 and August 9, (Beutenmuller).

In both sexes the whitish pollinose face will at once separate this species from *macrocera* Say. *C. macrocera* has the face brownish-yellow pollinose and the male has more erect, largely black, pile on the mesonotum and black pile on the dorsum of the abdomen.

Cerotainia feminea, new species

Related to *brasiliensis* Schiner but the third antennal segment is not much more than half as long as the first. Black, the legs partly reddish yellow. Length, about 5.5 mm.

Female.—Head brownish-yellow pollinose, the occiput sub-shining above, with reddish pollen. Bristles black, a few of those along the oral margin pale; pile of face and lower half of the occiput whitish, of the front and upper half of the occiput black. Palpi and proboscis black, yellow-haired, the latter with a pair of black bristles near the middle of the lower surface. Antennæ black, very long, the third segment unusually short; hair and bristles black.

Mesonotum and scutellum shining black, with extremely short, appressed, brown hair, in front with a yellow-haired fascia. Scutellum with about eight short bristly hairs on the margin. Pleura brownish-yellow pollinose, yellow-haired; mesopleura with one or two black bristles behind.

Legs black; coxæ grayish-yellow pollinose and pale yellow pilose. Anterior four tibiæ brownish, all the tibiæ broadly reddish at the base; basal segment of anterior tarsi, base of the second segment, and the base of the first and second segments of the posterior four tarsi, reddish. Hair yellowish, black on the upper surface of all the femora, posterior four tibiæ and on all the tarsi; bristles black, yellow on anterior tibiæ, posterior surface of the middle tibiæ and the basal segment of the anterior four tarsi.

Wings tinged with brown. Squamæ luteous, the fringe very short and yellowish. Halteres yellow.

Abdomen shining black, finely punctured, with extremely short black hair; sides narrowly and the venter with yellow hair; no bristles on the sides of the segments. Venter brown and with brown pollen.

Holotype.—Female, Corozal, Canal Zone, January 22, 1929, (Curran).

Cerotainia willistoni, new species

Related to *flavipes* Hermann, but at once separated by the yellow hair on face and front. Black, the tibiæ and tarsi yellow in the male; in the female the tibiæ are partly reddish brown and the tarsi are tinged with brown above. The female is distinguished from *brasiliensis* Schiner by the extensively yellow tibiæ, longer third antennal segment, etc. Length, 7.5 mm.

Male.—Head brownish-yellow pollinose, the front and occiput a little darker than the face; posterior orbits more gray below. Pile yellowish; bristles on the face and ocellar triangle and the orbital cilia black. Antennæ very long, blackish, thinly brown pollinose; third segment one-fourth longer than the first, the under surface of the apical half gray pollinose.

Thorax shining black; mesonotum with thick, appressed golden pile, the pile sparse on the anterior and broad posterior border and scutellum, the latter with about eight erect marginal hairs Pleura cinereous-yellow pollinose and yellow pilose, the mesopleura with a fine black bristle posteriorly

Coxæ and femora black, the former gray pollinose and yellow pilose, the femora with reddish-yellow apices, yellow-haired, the upper surfaces with brownish hair Tibiæ and tarsi reddish yellow, apical segment of the tarsi, and upper surface of the posterior tibiæ at the apex, brown, hair yellow, bristles on upper surface of posterior tibiæ and tarsi, black, the hair black on the apical segment of the tarsi and upper surface of the hind ones Posterior tibiæ ventrally with dense, erect short, whitish pile

Wings strongly tinged with brown, slightly paler basally Squamæ and their fringe yellow Halteres reddish yellow

Abdomen shining black, finely punctured, with very short hair which is brown on the dorsum and yellow on the sides and venter, no bristles except very fine ones on the sides of the first segment Venter brownish red, brown pollinose, the [illegible] of the st[illegible] yellow

FEMALE —[illegible] yellowish brown, the [illegible] and [illegible] broadly [illegible] golden-yellow-haired Anterior four tibiæ [illegible] red [illegible] brow[illegible] their posterior surface the posterior pair [illegible] brown [illegible] broad base and [illegible] Posterior tarsi brownish dorsally [illegible] brownish [illegible]

TYPES —Holotype male [illegible] ada, Brazil [illegible] pe, female, Chapada, November Paratypes three [illegible] d four fe[illegible] apada, and one female, Santarem, Brazil, all from the Williston Collection

ATOMOSIA Macquart

The key is far from complete and many species described from South America are omitted All the forms recognized from the United States are included

TABLE OF SPECIES

1	Border of scutellum without bristles on the entire margin	2
	Border of scutellum with bristly hairs on the entire margin	*venustula* Arribalzaga
2	Anterior femora and tibiæ not wholly pale yellow	3.
	Anterior femora and tibiæ wholly pale yellow	13.
3	Posterior tibiæ and tarsi with dense silvery hair	4
	Posterior tibiæ without dense silvery hair dorsally	5
4	Two ocellar bristles	*tibialis* Macquart
	Four or six ocellar bristles	*argyrophora* Schiner
5	No longer dorsocentrals among the appressed hair of the mesonotum	6
	Dorsocentral hairs or bristles always present	7
6	Collar with very stout bristles	*armata* Hermann
	Collar with fine hair	*nuda* Hermann
7	Thorax and abdomen metallic bronze-green	*metallescens* Hermann
	Thorax and abdomen black	8.
8	Hair of face and palpi wholly black	*melanopogon* Hermann.
	Hair of face and palpi yellow or white	9.

9. Scutellum with two bristles.......... 21.
Scutellum with four bristles.......... 10.
10. Ocellar tubercle with at most four bristles.......... 11.
Ocellar tubercle with six or more bristles.......... 12.
11. Posterior femora reddish with the apical half black.......... 22.
Posterior femora blackish with only the base and apex reddish brown.......... 20.
12. Ocellar tubercle with six bristles.......... *setosa* Hermann.
Ocellar tubercle with numerous bristles.......... *beckeri* Jænnicke.
13. Tarsi wholly black.......... 27.
At least the basal two segments of the tarsi not black.......... 14.
14. Ocellar tubercle with two bristles.......... 15.
Ocellar tubercle with six or more bristles.......... *anonyma* Williston.
15. Posterior calli partly or wholly reddish yellow.......... 17.
Posterior calli black.......... 16.
16. Posterior tibiæ wholly yellow.......... *sayi* Johnson.
Posterior tibiæ broadly black at apex.......... 23.
17. Apical three segments of posterior tarsi, and apical third of hind tibiæ, brownish, the femora wholly pale.......... 23.
Only the apical segment of the tarsi brown.......... 18.
18. Posterior femora brownish apically.......... *soror* Bigot.
Posterior femora wholly reddish or yellowish.......... 19.
19. Posterior tibiæ wholly yellow.......... *mucida* Osten Sacken.
Posterior tibiæ with apex broadly brown.......... *punctifera* Hermann.
20. Vertex shining black.......... *geniculata* Wiedemann.
Vertex with ochreous pollen.......... 26.
21. First antennal segment more than twice as long as the second. *glabrata* Say.
First antennal segment not twice as long as the second.......... *similis* Bigot.
22. Front above and middle of face brownish-golden pollinose.......... *frontalis*, n. sp.
Front and face white pollinose.......... *glabrata* Say.
23. Front shining black on median third for the whole length.......... *coxalis*, n. sp.
Front pollinose on anterior half or with a linear median shining vitta.......... 24.
24. Apical two or three tarsal segments brownish.......... 25.
Only the apical tarsal segment brownish.......... *rufipes* Macquart.
25. Posterior calli wholly black.......... 28.
Posterior calli reddish yellow.......... *eupoda* Bigot.
26. Face golden yellow.......... *macquarti* Bellardi.
Face white.......... 29.
27. Posterior calli yellow.......... *nigra* Bigot.
Posterior calli black.......... *panamensis*, n. sp.
28. Posterior femora black on apical third.......... *tenuis*, n. sp.
Posterior femora wholly reddish yellow.......... *lineata*, n. sp.
29. Ocellar tubercle with two black bristles and two white hairs.
melanopogon Hermann.
Ocellar tubercle with only the two black bristles; apical tarsal segment black-haired.......... *puella* Wiedemann.

Atomosia panamensis, new species

Related to *nigra* Bigot but the posterior femora are black except on their base and apex; anterior four legs yellow, the tarsi black. Length, 7 mm.

Female.—Head brownish-yellow pollinose, the face and lower third of the posterior orbits white. Hair and bristles white or pale yellowish; ocellar bristles black. Antennæ short, black, the third segment with a thorn at the apical fifth and a very small terminal style; first segment with yellow hair below, little more than twice as long as the second segment.

Thorax black, the lateral margins, anterior border of the humeri, and the pleura, gray pollinose. Pronotum and a narrow prescutellar band with reddish-brown pollen: pronotal bristles fine, whitish. Mesonotum and scutellum with very short brassy-yellow pile, the scutellum with six fine marginal bristles of the same color; [illegible] sides of mesonotum black. Pile of pleura pale yellow; metanotal [illegible] with yellow [illegible]

Coxæ black, [illegible] pollinose. Legs yellowish; tarsi black; [illegible] femora black except the base and apex, their tibiæ black on the apical third. Hair and bristle pale yellowish, many of the bristles reddish yellow: posterior tibiæ on dorsal surface of the apical third and the upper surface of [illegible] bristles, the other tarsi with whitish hair and black bristles.

[illegible] tinged with dark brown, paler basally [illegible] fringe of squamæ yellow. Halteres pale yellow.

Abdomen shining black, with very [illegible] es of the segments with somewhat longer yellow hair on the posterior [illegible] with a band of pale hair at the base: these bands are visible only in certain lights; lateral margins and venter yellowish haired. Venter brown, gray pollinose.

Holotype.—Female, Barro Colorado Island, Canal Zone, January 8, 1929, (Curran).

Atomosia melanopogon Hermann

Hermann, 1912, Abh. Kaiserl. Leop.-Carol. Deutsch. Ak. der Naturf., XCVI, p. 144.

I have three specimens which I place here. The males have the bristles and hair of the face black and agree with the description. The female, however, has the hair white, thus agreeing with *puella*. In both sexes there are four or six hairs and bristles on the ocellar tubercle and the apical three tarsal segments bear white hair above, the posterior tarsi with the basal two segments black-haired above. The ocellar bristles may be all whitish or four of them may be black, and only one pair is strong.

Hermann described the species from Texas. The specimens before me are from Arizona, Colorado, and Iowa.

Atomosia frontalis, new species

Related to *glabrata* Say but the front is golden pollinose except on the sides of the anterior half. Black, the legs largely reddish and yellow. Length, 6 mm.

Male (?).—Head brownish-golden pollinose, sides of front on anterior half, sides and lowest fourth of the face, the cheeks and lower half of the occiput with whitish pollen. Hair whitish; bristles pale yellow. Basal two antennal segments shining black, with yellow hair and bristles, the first segment about three times as long as the second: third segment missing.

Mesonotum and scutellum shining black, with short, appressed white hair; scutellum with two short, yellowish bristles on either side, the mesonotum with a black and yellowish bristle laterally. Pleura cinereous-white pollinose, the mesopleura mostly shining; hair pale yellow, the mesopleural bristle rusty yellow.

Coxæ black, densely cinereous pollinose and pale yellow pilose. Femora reddish, the anterior four ferruginous on the upper surface for most of their length, the posterior pair blackish on the subapical half. Tibiæ reddish with the apical fourth or more shining brown. Tarsi dark brown, the basal segment mostly reddish. Hair and bristles pale yellow, the posterior tibiæ with abundant erect, white pile below.

Wings grayish, pale yellowish brown on basal half except posteriorly. Border of squamæ pale yellow, the hair whitish. Halteres pale yellow.

Abdomen shining black; thickly punctate; tips of segments narrowly cinereous pollinose; hair extremely short, yellowish brown; first segment with three or four, second with two pale yellowish bristles on either side.

The venter has been destroyed so that it is not possible to describe the under surface of the abdomen or determine the sex.

Holotype.—Male (?), Chapada, Brazil, (Williston Collection).

Atomosia coxalis, new species

Black, slender, legs, including the coxæ, yellow; front shining black except on the broad sides of the anterior third. Length, 6 to 7 mm.

Male.—Face, sides of front below, cheeks and lowest sixth of the occiput white pollinose; occiput with brown pollen, the front and a large area between the vertex and neck shining black. Hair and bristles white; a pair of ocellar bristles, and the orbital cilia, black. Antennæ elongate, the third segment more than twice as long as the first, the first about three times as long as the second; hair and bristles black.

Thorax black, the posterior calli reddish; hair of mesonotum and scutellum very short, appressed, white or pale yellow; scutellum with one pair of strong black bristles. Pleura cinereous white pollinose, the hypopleura brown; mesopleura with small oval shining black spot in the middle and with a long black bristle behind; hair pale yellow. Humeri shining black.

Legs, reddish yellow; coxæ white pollinose; pile and bristles yellow, black on the dorsal surface of the posterior tarsi. Apical sixth of the posterior tibiæ and the apical two segments of the tarsi brown, the third segment sometimes brownish red.

Wings cinereous hyaline, brownish at the apex. Squamæ and fringe and the halteres pale yellow.

Abdomen shining black, the tips of the segments gray pollinose; pile very short, appressed, pale yellowish; longer on the sides and venter. First segment with two or three, the second with a single yellowish bristle on either side. Venter brownish red, pale pollinose.

Female.—Differs only sexually.

Types.—One male and seven females from Corumba, Brazil, (Williston Collection). The holotype, male, and allotype, female, were taken in April.

This is a slender species and is readily recognized by the yellow coxæ.

Atomosia lineata, new species

Related to *coxalis* Curran but the coxæ are black in ground color and there is only a slender median line of black in front of the ocellar tubercle. Length, 7.5 mm.

MALE.—Head silvery-white pollinose; occiput with brown pollen; a large rectangular area below the vertex and the posterior half of the front, shining black. Hair and bristles white; occipital cilia, ocellar bristles and hair of antennæ black. Antennæ black; second segment brown, about one-third as long as the first; third segment missing.

Thorax black, the mesonotum and scutellum with extremely short, appressed white hair, the bristles black; one pair of scutellars Humeri shining, posterior calli brown. Pleura grayish pollinose, the mesopleura with a large, oval bare spot [illegible] middle and a strong whitish bristle behind; pile pale yellow.

[illegible]: coxæ black, whitish pollinose and pile [illegible] yellow; apical [illegible] and apical two tarsal [illegible] hair and bristles yellowish [illegible] black [illegible] and the apical two segments [illegible] the anterior [illegible].

Wings cinereous [illegible] broadly tinged with b[illegible] ally Squamal fringe pale yellow the halteres of the same color.

Abdomen black, finely punctured: apices of seg[illegible] gray. Pile [illegible] appressed, very pale yellow [illegible] first [illegible] segments with one or more whitish bristles Venter b[illegible] s of segments pale.

FEMALE.—Differs only sexually.

TYPES.—Holotype, male, allotype, female, and two female paratypes, Corumba, Brazil, May, (Williston Collection).

This species differs from *eupoda* Bigot in being more slender and in having the posterior calli black.

Atomosia tenuis, new species

Related to *coxalis* Curran but the coxæ are black, the middle of the front broadly pollinose behind the ocellar tubercle, posterior femora black on apical half, etc. Length, 7 mm.

MALE.—Head white pollinose and pilose; occiput above the neck, and the slopes of the front behind the ocellar tubercle, shining black. Occipital cilia, ocellar bristles and those on the lower surface of the basal antennal segment yellow. Antennæ brown; first segment black, yellowish haired on basal two-thirds of lower surface. Antennæ long, the third segment twice as long as the first, the brownish-gray pollinose sensory area occupying more than the apical half of the inner surface; first segment more than three times as long as the second; hair black.

Thorax black; mesonotum and scutellum with short, brassy yellow pile and bristles; scutellum with a fine bristle on either side. Pleura gray pollinose, a large spot on the mesopleura and a smaller one on the pteropleura shining black. Pleural pile white; trichostical hairs and the single fine bristle on the posterior border of the mesopleura pale yellow.

Coxæ black, cinereous-white pollinose and white pilose. Trochanters and femora reddish yellow, the posterior femora black on the apical half except the tip. Anterior four tibiæ and basal three segments of their tarsi, reddish yellow; posterior tibiæ black with the basal fourth reddish, posterior tarsi and apical two segments of the

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TICKS COLLECTED BY THE AMERICAN MUSEUM CONGO EXPEDITION 1909–1915, WITH NOTES ON THE PARASITES AND PREDACIOUS ENEMIES OF THESE ARTHROPODS[1]

By J. Bequaert[2]

The present paper lists, in addition to the ticks obtained in the Belgian Congo by Messrs. H. Lang and J. P. Chapin from 1909 to 1915, a few specimens collected by Dr. J. P. Chapin during his more recent expedition of 1927. The ticks of the Lang-Chapin Expedition were sent several years ago to Dr. S. Hadwen, but he returned them to the Museum without completing their study and without writing a report.

I have preceded the enumeration of the species with a brief review of what is known of the parasites and predacious enemies of ticks, a subject of much biological interest as well as of some practical importance. The paper concludes with a list of the ticks known at present from the Belgian Congo.

Parasites and Predacious Enemies of Ticks

Ticks are rather unusually free from the attacks of parasites and predacious enemies, perhaps because during so much of their life they are safely concealed within the fur, feathers, or scales of their hosts. It seems probable that unfavorable weather conditions (especially excessive moisture and cold) are chiefly responsible for keeping their numbers in check. Ticks are also adversely affected by the destruction of their potential hosts, either by hunting or through natural causes, such as epidemics. In the savannas of Africa large numbers of them are undoubtedly wiped out by the grass-fires that almost yearly sweep over the country toward the end of the dry season.

Of the few internal parasites of ticks, the best known is a minute chalcid wasp—often referred to as a "fly" in medical literature—of the family Encyrtidæ, *Ixodiphagus caucurtei* R. du Buysson (1912, Arch. de Parasitologie, XV, p. 246, Fig. 1), which in France commonly parasitizes the nymphs of *Ixodes ricinus* (Linnæus). It has also been found to attack the nymphs and, it would seem, occasionally the larvæ of other ticks belonging to the genera *Hæmaphysalis*, *Rhipicephalus*, and *Dermacentor*. Recently this parasite has been introduced with some success on the eastern coast of the United States and in Montana, for the purpose of controlling ticks. Two other chalcid wasps have been described from ticks: *Ixodiphagus texanus* L. O. Howard (1907, Ent. News, XVIII, p. 377, Pl. I), bred from nymphs of *Hæmaphysalis leporis-palustris* (Packard), in Jackson Co., Texas; and *Hunterellus hookeri* L. O. Howard (1908, Canad. Entom., XL, p. 241, Fig.), bred from *Rhipicephalus sanguineus* var. *texanus* Banks, off a Mexican dog at Corpus Christi, Texas. The generic and specific differences of these three parasites are somewhat open to discussion. H. P. Wood (1911, Journ. Econ. Entom., IV, p. 426) reports that *Hunterellus hookeri* was bred from a nymph of *Rhipicephalus sanguineus*, at Lourenzo Marques, by C. W. Howard. The same or similar parasites undoubtedly exist elsewhere in Africa. Cooley[1] has recently announced the discovery of chalcid parasites (probably of the species *Ixodiphagus caucurtei*) in nymphs of *Hyalomma ægyptium impressum*, near Pretoria, Transvaal. Bedford bred the same parasite from nymphs of *Rhipicephalus evertsi*. Cooley also states that this chalcid was found at Durban, Natal, in nymphs of *Hæmaphysalis leachii* and that it occurs in West Africa.

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[1] Scientific Results of the Congo Expedition. Entomology No. 23.

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W. D. Hunter and W. A. Hooker (1907, U. S. Dept. Agric., Bur. Entom., Bull. No. 72, p. 36) mention breeding a species of Phoridæ from the eggs of the tick, *Boophilus annulatus* (Say), in Texas. But, so far as I have been able to trace, the specific identity of this parasite has not been determined.

Hunter and Hooker (1907, *loc. cit.*) have also shown experimentally that the fire-ant, *Solenopsis geminata* (Fabricius), will carry off ticks of the species *Boophilus annulatus*. Dutton and Todd (1905, Liverpool School Trop. Med., Mem. XVII, p. 17) state that *Ornithodoros moubata* (Murray), the carrier of African human recurrent fever, is not without natural enemies: "Rats eat adults with avidity, and ants carry off young ones and eggs. We have lost ticks in both ways. On one occasion over two hundred young ticks were carried off in a single night by small ants." According to A. Theiler (1911, Schweiz. Arch. f. Tierheilk., LIII, p. 65) ants destroy many of the ticks which drop off from their hosts; but he records no definite observations nor does he state which species of ant is involved. F. C. Wellman (1908, Ent. News, XIX, p. 27; see also Austen,

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[1] Cooley, R. A. 1929 (June). 'A Summary of Tick Parasites Studies.' South African Journ. Nat. Hist., VI, part 4, pp. 266–272 (with remarks by G. A. H. Bedford).

1906, Journ. Trop. Med. Hyg., London, IX, p. 113) reports that a reduviid bug, *Phonergates bicoloripes* Stål (locally known as "ochindundu"), in Benguella, attacks and kills the fever tick, *Ornithodoros moubata* (Murray). This reduviid, however, does not appear to be a very widespread or very active enemy of *Ornithodoros*. At any rate, during my travels in Africa I have looked in vain for it in many localities infested with the tick.[1]

The most efficient predacious enemies of ticks are found among the birds. Domestic fowl will eat them when given a chance to pick them from domestic animals. McAtee has compiled some of the observations of tick-eating birds in North and Central America and the West Indies.[2] The most important of these is the groove-billed ani, *Crotophaga sulcirostris* Swainson, called "garrapatero" in all Spanish-American countries and "tick-bird" in the West Indies, while the generic name refers to the partiality of this bird for ticks. A. E. Wetmore (1916, Bull. 326, U. S. Dept. Agric., Prof. Paper, pp. 118–119) mentions finding engorged females of the cattle-tick, *Boophilus annulatus* (Say), in the stomach of a blackbird, *Holoquiscalis brachypterus* (Cassin), in Porto Rico. Hunter and Hooker (1907, U. S. Dept. Agric., Bur. Entom., Bull. No. 72, p. 17) have recorded observations of the great-tailed grackle, *Quiscalus macrourus* Swainson, and the kingbird, *Tyrannus tyrannus* (Linnæus), picking ticks from cattle in Texas and Louisiana.

The true tick-birds or oxpeckers of the genus *Buphagus* are exclusively African, not being found even in Madagascar, and are specific enemies of ticks. Two distinct species (and two races) are found in the savannas of Africa, where they are often seen clinging to the backs and flanks of cattle, horses, asses, goats, and certain big game.[3] That these birds feed to a large extent upon ticks is well known, although there seem to be few autopsies on record to substantiate the belief. Arthur Loveridge (1928, Proc. Zool. Soc. London, p. 77) found three species of ticks in the stomach of *Buphagus erythrorhynchus* (Shelley), in Tanganyika Territory: *Amblyomma* sp., *Ixodes pilosus* Koch, and *Rhipicephalus* sp. (? *punctatissimus* Gerstæcker).

Dr. James P. Chapin has contributed the following account of his stomach examinations of *Buphagus*:

B. africanus megarhynchus Grote. In two stomachs examined in the Upper Uele District, several ticks were found, also many short hairs, one small insect, and some small slender seeds. These two birds had been shot near wild animals (not cattle); one was said to have been with a white rhinoceros, while the other came back to a buffalo that had been shot. The stomach of a bird shot at Uvira, near a herd of cows, contained six to eight ticks and hair from the cows.

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[1] Miss Chodziesner's statement, "Die Wanze *Phonergates bicoloripes* ist in Westafrika allgemein als Zeckenvernichter bekannt" (1924, Zool. Jahrb., Abt. Syst., XLVII, p. 526), is more than an exaggeration.

[2] McAtee, W. L. 1911. 'Bird Enemies of the Texas-fever Tick and Other Ticks.' The Auk, XXVIII, pp. 136–138.

[3] See Lang, H. 1924. 'The Eland and Its Bird Sentinel.' Natural History, XXIV, pp. 96–97.

B. africanus langi Chapin. Two stomachs, at Zambi, were both filled with ticks and short hairs. The hairs are doubtless pulled from the animals' hides, but perhaps remain in the birds' stomachs much longer than the more digestible ticks.

B. erythrorhynchus (Shelley). One bird of Embu, Kenya Colony, showed, in the stomach, four ticks and many short pieces of hair. Another, from Southern Guaso Nyiro, Kenya Colony, likewise had hairs and some ticks.

Both species of oxpeckers are accused of pecking at the borders of sores or wounds, but I think the hairs are likely to be pulled out in catching the ticks. In the stomach with the ticks there is usually some dark, red-brown ooze that looks like old blood. I believe it comes out of the ticks, rather than being blood drunk directly by the birds.

It is generally believed by Europeans in Africa that a white heron, *Bubulcus ibis* (Linnæus), which is often found in numbers near grazing cattle, cleans the animals of their ticks.[1] Stomach examinations, however, lend no suppport to this view. In this connection, Dr. J. P. Chapin writes:

> After watching these herons stalking about among horses and cows at pasture, I have been convinced that their sole object is to secure the insects stirred up, or sometimes attracted by the beasts, whereas parasites such as ticks offer little or no temptation. Dr. Bequaert, at Nyangwe and Kasongo, twice examined stomachs of birds accompanying cattle and found therein grasshoppers, ants, and a hemipter, but no ticks. The seven stomachs I looked through were largely filled, in six cases, with grasshoppers; but other unidentified insects were numerous. One cricket was noted and, besides some maggot-like larvæ, a number of large carrion-flies. Never, however, were there any ticks.

A similar mistake is often made with regard to the feeding habits of the North American cowbird, *Molothrus ater* (Boddaert), which owes its vernacular name to its frequently observed association with cattle, horses and sheep, and formerly also with bison. The opinion has usually been held that the cattle provide the birds with food in the form of ticks, flies, or bot-fly larvæ. Stomach examinations, however, have shown that grasshoppers and leaf-hoppers are the cowbird's favorite food, these insects being stirred up as the cattle move about the pasture. No ticks were ever found in the stomachs.[2]

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[1] As a consequence, this bird is universally known as the "pique-bœuf" among the whites in the Belgian Congo, while few of them are aware of the existence of the true oxpeckers.

[2] Friedmann, H. 1929. 'The Cowbirds. A Study in the Biology of Social Parasitism.' (Springfield, Ill., and Baltimore, Md.), xvii +421 pp., 29 Pls. (association with cattle and food of the North American cowbird, pp. 284–300).

APPROXIMATE LOCATION OF LOCALITIES MENTIONED

Aba, 3° 50′ N., 30° 10′ E.
Akenge, 2° 55′ N., 26° 50′ E.
Avakubi, 1° 20′ N., 27° 40′ E.
Bunyoni (Lake), 1° 20′ S., 30° E.
Faradje, 3° 40′ N., 29° 40′ E.
Garamba, 4° 10′ N., 29° 40′ E.
Lubero, 0°, 29° E.
Medje, 2° 25° N., 27° 30′ E.
Niapu, 2° 20′ N., 26° 45′ E.
Pawa, 2° 25′ N., 27° 50′ E.
Ra-u, western slope of Mt. Ruwenzori.
Zambi, 6° S., 12° 50′ E.

Argantidæ

Ornithodoros moubata (Murray)

Argas moubata ANDR. MURRAY, 1877, 'Economic Entomology, Aptera,' I, p. 182, Fig. (Angola).

Ornithodoros savignyi var. *cæcus* NEUMANN, 1901, Mém. Soc. Zool. France, XIV, p. 256 (from many African localities).

BELGIAN CONGO.—Lubero, in native huts, at the altitude of 6,500 ft., March 12, 1927 (J. P. Chapin). This dangerous tick has been recently reported from the same locality by Flamand (1929, Rev. Zool. Afric., XVI, 4, p. [68]).

This tick, the carrier of human recurrent fever in tropical Africa, is commonly known by the natives of the eastern Congo as "kimputu."

Ixodidæ

Ixodes daveyi Nuttall

Ixodes daveyi NUTTALL, 1913, Parasitology, VI, p. 133, Fig. 2 (♀; off *Ruwenzorornis johnstoni* Sharpe, on the northern ridge of Mt. Ruwenzori, at the boundary between the Belgian Congo and Uganda). BEDFORD AND HEWITT, 1925, South African Journ. Nat. Hist., V, p. 260. BEDFORD, 1927, 11th and 12th Repts. Dir. Vet. Res., Union of South Africa, I, p. 728.

BELGIAN CONGO.—Pawa, one engorged female clinging to the head of a warbler, *Cisticola natalensis kapistra* Lynes, July 10, 1913 (J. P. Chapin).

This interesting tick appears to be a specific parasite of birds. It has also been found in the Transvaal on a pink-billed weaver, *Quelea sanguinirostris lathami* (A. Smith).

From the more common bird-tick, *Ixodes brunneus* Koch (also found in tropical Africa), the female of *I. daveyi* differs in having a horseshoe-shaped anal groove, with converging posterior branches. In *I. brunneus*, the posterior branches of the anal groove are parallel or slightly divergent. The males of both species are as yet unknown and should be looked for in the nests of the birds.

Ixodes simplex Neumann

Ixodes simplex NEUMANN, 1906, Arch. de Parasitologie, X, p. 197 (described from one ♀ of unknown locality, one ♀ off *Rhinolophus ferrum-equinum* at Shanghai, and one ♀ off *Vespertilio* sp. in the Gaboon). NUTTALL AND WARBURTON, 1911, 'Ticks,' II, *Ixodes*, p. 207, Fig. 199 (♀).

BELGIAN CONGO.—I refer to this species one nymph found on a bat at Aba, December, 1912 (H. Lang and J. P. Chapin). It agrees remarkably well with Nuttall and Warburton's description and figure of the female. While the legs are longer than usual in *Ixodes*, they are decidedly shorter and less "spider-like" than in the more common bat-tick, *Ixodes vespertilionis* Koch. This nymph differs, moreover, from that of *I. vespertilionis* in having divergent posterior branches of the anal groove, the cervical grooves of the scutum more distinct, and the coxæ decidedly flattened.

Amblyomma paulopunctatum Neumann

Amblyomma paulopunctatum NEUMANN, 1899, Mém. Soc. Zool. France, XII, p. 248 (♂; Konakry, French Guinea). ROBINSON, 1926, 'Ticks,' IV, *Amblyomma*, p. 82, Figs. 36–37, Pl. VI, fig. 2 (♂, ♀).

Amblyomma sparsum paulopunctatum NEUMANN, 1905, Arch. de Parasitologie, IX p. 233; 1911, 'Das Tierreich,' Lief. 26, Acarina, Ixodidæ, p. 78 (♂).

Amblyomma trimaculatum NEUMANN, 1908, Notes Leyden Mus., XXX, p. 84, Figs. 5–7 (♀; Robertsport, Liberia).

BELGIAN CONGO.—Medje, numerous females and males, off black forest pig, *Hylochœrus meinertzhageni ituriensis* Matschie, June, 1914 (H. Lang and J. P. Chapin). Some specimens of this lot appear to have been sent to Robinson by Dr. S. Hadwen and were listed by Robinson in his Monograph as from "West Africa."

This tick is peculiar to the West African Subregion, being known at present from Sierra Leone, Liberia, French Guinea, the Belgian Congo, and Uganda. Its host is here recorded for the first time.

Amblyomma tholloni Neumann

Amblyomma tholloni NEUMANN, 1899, Mém. Soc. Zool. France, XII, p. 242 (♂, ♀; off elephant; Congo, Upper Ubangi, and regions of Lake Nyasa and Lake Tanganyika).

BELGIAN CONGO.—Faradje, one male and two females, off elephant, *Loxodonta africana* (Blumenbach), April, 1911 (H. Lang and J. P. Chapin).

This is the most common and the most widely distributed of the ticks found on the African elephant.

Amblyomma variegatum (Fabricius)

Acarus variegatus Fabricius, 1798, 'Entom. Syst. Suppl.,' p. 572 (no sex; Africa).

Belgian Congo.—Garamba, one male, off plain's buffalo, *Syncerus caffer* (Sparrman), July 5, 1912, and several males, off giant eland, *Taurotragus derbianus gigas* (Heuglin), March, 1912 (H. Lang and J. P. Chapin). Faradje, several males and females, off cattle (H. Lang and J. P. Chapin). Zambi, several males, off cattle, June, 1915 (H. Lang).

Amblyomma splendidum Giebel

Amblyomma splendidum Giebel, 1877, Zeitschr. Ges. Naturwiss., XLIX, p. 295 (♂, ♀; off buffalo, Gaboon).

Belgian Congo.—Zambi, several males and females, off cattle, June, 1915 (H. Lang).

Amblyomma cuneatum Neumann

Amblyomma cuneatum Neumann, 1899, Mém. Soc. Zool. France, XII, p. 233 (♂; Congo).

Belgian Congo.—Avakubi, several males, females, and nymphs, off *Manis tricuspis* Rafinesque, October 29, 1909 (H. Lang and J. P. Chapin). Akenge, one male, off *Hylochœrus meinertzhageni ituriensis* Matschie, October, 1913 (H. Lang and J. P. Chapin); this record has been listed by Robinson, 1926, 'Ticks,' IV, *Amblyomma*, p. 143. The ticks of *Manis* were numerous between the scales of the neck and limbs, according to Mr. H. Lang.

Aponomma exornatum (C. L. Koch)

Amblyomma exornatum C. L. Koch, 1844, Arch. f. Naturgesch., X, 1, p. 231 (♂, ♀; Christmas Bay, South Africa).

Belgian Congo.—Aba, several males and females, supposedly "off bats," December, 1912 (H. Lang and J. P. Chapin).

This tick is a common ectoparasite of reptiles, especially of monitors. Specimens which I obtained off *Varanus niloticus* (Linnæus), at Bukama, were fixed in the armpits of the fore legs. J. Schwetz has recorded it from a crocodile at Mateba, in the estuary of the Congo River. Its occurrence on bats, if confirmed, would be of unusual interest.

Rhipicephalus sanguineus (Latreille)

Ixodes sanguineus Latreille, 1806, 'Gen. Crust. Ins.,' I, p. 157 (no sex; France).

Belgian Congo.—Faradje, one engorged female, clinging to the head of a hawk, *Butastur rufipennis* (Sundevall), February 1, 1913 (J. P. Chapin).

This is the common tick of domestic dogs, found often on other animals also, and there have been several previous records from birds.

Rhipicephalus simus C. L. Koch

Rhipicephalus simus C. L. Koch, 1844, Arch. f. Naturgesch., X, 1, p. 238 (♂; South Africa).

Belgian Congo.—Medje, two females, without host, January 22, 1910 (H. Lang and J. P. Chapin).

Rhipicephalus simus var. **shipleyi** Neumann

Rhipicephalus shipleyi Neumann, 1902, Arch. de Parasitologie, VI, p. 112 (♂, ♀; off hyena, Sudan).

Belgian Congo.—Garamba, several males and females, off plain's buffalo, *Syncerus caffer* (Sparrman), and off giant eland, *Taurotragus derbianus gigas* (Heuglin), March, 1912 (H. Lang and J. P. Chapin).

Rhipicephalus aurantiacus Neumann

Rhipicephalus aurantiacus Neumann, 1907, Notes Leyden Mus., XXIX, p. 90, Figs. 3–4 (♂, ♀; off *Syncerus brachyceros*, Liberia).

Belgian Congo.—Medje, off forest buffalo, *Syncerus planiceros* (Blyth), May 7, 1910 (H. Lang and J. P. Chapin).

This tick has been known thus far only from Liberia.

Rhipicephalus longus Neumann

Rhipicephalus longus Neumann, 1907, Ann. Trop. Med. Paras., I, p. 117, Figs. 24–25 (♂; off cattle, Kasongo, Belgian Congo).

Rhipicephalus falcatus Neumann, 1908, Notes Leyden Mus., XXX, p. 77, Fig. 4 (♂, ♀; north of Lake Nyasa and Liberia). Warburton, 1912, Parasitology, V, p. 20.

Belgian Congo.—Medje, off forest buffalo, *Syncerus planiceros* (Blyth), May 7, 1910 (H. Lang and J. P. Chapin). Garamba, off plain's buffalo, *Syncerus caffer* (Sparrman), July 5, 1912, and off giant eland, *Taurotragus derbianus gigas* (Heuglin), March, 1912 (H. Lang and J. P. Chapin).

As Warburton (1912) has shown, *R. longus* was based upon a rather ill-characterized male of *R. falcatus*. The species must nevertheless be known under the name *R. longus*, which has priority.

Rhipicephalus supertritus Neumann

Rhipicephalus supertritus Neumann, 1907, Arch. de Parasitologie, XI, p. 216, Figs. 2–3 (♂; off horse, shores of the Lualaba River, Belgian Congo); 1908, Notes Leyden Mus., XXX, p. 79 (♂, ♀); 1911, 'Das Tierreich,' Lief. 26, Acarina, Ixodidæ, p. 39 (♂, ♀). Warburton, 1912, Parasitology, V, p. 20.

Rhipicephalus coriaceus Nuttall and Warburton, 1908, Proc. Cambridge Phil. Soc., XIV, 4, p. 402, Figs. 17–20 (♂, ♀; Nyasaland and Benguella).

Belgian Congo.—Garamba, one male, off giant eland, *Taurotragus derbianus gigas* (Heuglin), March, 1912 (H. Lang and J. P. Chapin).

This specimen, found among a lot of *R. longus* and *R. simus* var. *shipleyi*, agrees in every respect with the descriptions of both *R. supertritus* and *R. coriaceus*, as well as with a series off eland, from Nyasaland, named "*R. coriaceus*" by Warburton.

Rhipicephalus dux Dönitz

Rhipicephalus dux Donitz, 1910, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 275, Figs. 1–3 (♂, ♀; off an unknown host, possibly elephant, Upper Congo).

Rhipicephalus schwetzi Larrousse, 1927, Rev. Zool. Afric., XV, part 2, p. 214, Fig. (♂, ♀; off *Hylochœrus meinertzhageni ituriensis*, Koteli, on the Itimbiri, Belgian Congo).

Belgian Congo.—Medje, three males and ten females, off forest buffalo, *Syncerus planiceros* (Blyth), May 7, 1910 (H. Lang and J. P. Chapin). Avakubi, three males and two females, off a red river-hog, *Potamochœrus porcus* (Linnæus), October 26, 1909 (H. Lang and J. P. Chapin).

This remarkable species is quite distinct from *R. pulchellus* (Gerstæcker) and *R. maculatus* Neumann, the only other members of the genus with an ornate scutum. Of the males in these lots, one is marked as described and figured by Dönitz for his *R. dux*, while the others have the pattern of Larrousse's *R. schwetzi*. There is no doubt that Larrousse redescribed *R. dux*, the description of which he seems to have overlooked, since he does not mention it in discussing the affinities of his *R. schwetzi*. Engorged females of this species may reach a total length of 15 mm.

Boophilus decoloratus (C. L. Koch)

Rhipicephalus decoloratus C. L. Koch, 1844, Arch. f. Naturgesch., X, part 1, p. 239 (♀; South Africa).

Belgian Congo.—Zambi, several engorged females off cattle, June, 1915 (H. Lang). Faradje, several engorged females, off a cow, December 25, 1912 (H. Lang and J. P. Chapin). Niapu, two engorged females, off a sitatunga, *Limnotragus spekei gratus* Sclater, January, 1914 (H. Lang and J. P. Chapin).

Dermacentor rhinocerinus (Denny)

Ixodes rhinocerinus Denny, 1843, Ann. Mag. Nat. Hist., XII, p. 313, Pl. xvii, fig. 3 (♂; off *Rhinoceros bicornis*, South Africa).

Dermacentor rhinocerinus DÖNITZ, 1910, Denkschr. Med.-Naturw. Ges. Jena, XVI, p. 483, Pl. XV, fig. 8 and Pl. XVII, fig. 14 (♂, ♀).

Dermacentor rhinocerotis NEUMANN, 1897, Mém. Soc. Zool. France, X, p. 370, Figs. 25–26 (♂, ♀). (Not *Acarus rhinocerotis* de Geer.)

Dönitz has pointed out that de Geer's *Acarus rhinocerotis* (1778, Mém. pour servir à l'Hist. des Ins., VII, p. 160, Pl. XXXVIII, figs. 5–6; off rhinoceros, Cape of Good Hope) was a tick with long palpi and therefore probably an *Amblyomma*, a genus of which several species have been found on rhinoceros. Perhaps it was *A. marmoreum* Koch.

BELGIAN CONGO.—Faradje, numerous males and females in four lots, off white rhinoceros, *Ceratotherium simum cottoni* Lydekker, March and April, 1911 (H. Lang and J. P. Chapin).

This tick is the most common parasite in East and South Africa of both the white and the black rhinoceros, which appear to be its only true hosts. The specimens obtained by the Lang and Chapin Expedition belong to the typical form. There is, however, some variation in the extent and shape of the markings of the scutum, especially in the male; in that sex, the pale, somewhat metallic spots of the anterior half may be either completely separated, or partly or almost entirely fused so as to simulate a female scutum (forming a so-called pseudoscutum, which, according to P. Schulze, corresponds morphologically to the true scutum of the female). In view of these facts, I doubt the validity of the subspecies *permaculatus* Neumann (1907, in Sjöstedt, 'Wiss. Ergebn. Schwed. Zool. Exp. Kilimandjaro,' III, Abt. 20, p. 23; ♂; Kibonoto, Kilimanjaro), which was probably based upon an individual variation. There is also considerable difference in size, males in the same lot measuring from 4 to 8 mm. in total length.

Dermacentor circumguttatus Neumann

Dermacentor circumguttatus NEUMANN, 1897, Mém. Soc. Zool. France, X, p. 374, Fig. 27 (♂, ♀; Congo and Upper Ubangi).

BELGIAN CONGO.—Faradje, off elephant, *Loxodonta africana* (Blumenbach), April, 1911 (H. Lang and J. P. Chapin). These specimens were named by Dr. S. Hadwen. I have not seen them.

Haemaphysalis leachii (Audouin)

Ixodes leachii AUDOUIN, 1827, in Savigny, 'Descr. de l'Egypte,' 2nd Ed., XXII, Zool., p. 428 (♂; Egypt); [1826, Atlas, Pl. IX, fig. 9; without name].

BELGIAN CONGO.—Medje, without host, January 22, 1910 (H. Lang and J. P. Chapin). Niapu, several males inside the ears of an otter, *Aonyx capensis* (Schinz), January, 1914 (H. Lang and J. P. Chapin).

Faradje, several males, off _Herpestes ichneumon funestus_ (Osgood), January 16, 1912 (H. Lang and J. P. Chapin). Ra-u, on the western slope of Mt. Ruwenzori, 6,000 ft., many males off _Civettictis civetta orientalis_ (Matschie), January 12, 1927 (J. P. Chapin).

UGANDA.—Lake Bunyoni, one female off a clawed otter, _Lutra maculicollis_ Lichtenstein, April 8, 1927 (J. P. Chapin).

TICKS KNOWN FROM THE BELGIAN CONGO

The following list is based upon a critical study of published records, as well as upon an examination of several large collections of African ticks. Asterisks mark the names of the forms of which I have seen specimens from the Belgian Congo. It may be noticed that, of the 50 forms (45 species and 5 varieties) listed, only six are as yet unknown to me from the territory here under consideration.

ARGANTIDÆ

Argas persicus (Oken)
*_Ornithodoros moubata_ (Murray)

IXODIDÆ

*_Ixodes cavipalpus_ Nuttall and Warburton
* " _daveyi_ Nuttall
* " _rasus_ Neumann
* " _rubicundus_ Neumann var. _limbatus_ Neumann
* " _simplex_ Neumann
* " _ugandanus_ Neumann
*_Amblyomma cohærens_ Dönitz
* " _cuneatum_ Neumann
* " _eburneum_ Gerstæcker
* " _marmoreum_ C. L. Koch
* " _nuttallii_ Dönitz
* " _paulopunctatum_ Neumann
" _petersii_ Karsch
* " _pomposum_ Donitz
* " _splendidum_ Giebel
* " _tholloni_ Neumann
* " _variegatum_ (Fabricius)
*_Aponomma exornatum_ (C. L. Koch)
* " _læve_ Neumann
*_Hyalomma ægyptium_ var. _albiparmatum_ P. Schulze
*_Rhipicephalus appendiculatus_ Neumann
* " _aurantiacus_ Neumann
* " _bursa_ Canestrini and Fanjago

*_Rhipicephalus capensis_ C. L. Koch
* " " var. _compositus_ Neumann
* " _complanatus_ Neumann
* " _deltoideus_ Neumann
* " _duttoni_ Neumann
* " _dux_ Dönitz
" _evertsi_ Neumann
* " " var. _mimeticus_ Dönitz
* " _longus_ Neumann
* " _neavei_ Warburton
* " _sanguineus_ (Latreille)
" " var. _punctatissimus_ Gerstæcker
* " _simpsoni_ Nuttall
* " _simus_ C. L. Koch
" " var. _lunulatus_ Neumann
* " " var. _shipleyi_ Neumann
* " _sulcatus_ Neumann
* " _supertritus_ Neumann
* " _tricuspis_ Dönitz
*_Boophilus decoloratus_ (C. L. Koch)
*_Dermacentor circumguttatus_ Neumann
* " _rhinocerinus_ (Denny)
*_Rhipicentor gladiger_ (Neumann)
*_Hæmaphysalis leachii_ (Audouin)
* " _parmata_ Neumann.

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HERPETOLOGICAL RESULTS OF THE WHITNEY SOUTH SEA EXPEDITION IV.[1] DESCRIPTIONS OF NEW SPECIES OF LIZARDS FROM THE PACIFIC ISLANDS (SCINCIDÆ)

By Charles E. Burt

The new species diagnosed below were discovered during the recent identification of the enormous collection of lizards brought back by the Whitney South Sea Expedition. In order that these findings may be made immediately available to others working in the field, preliminary descriptions are offered here. Detailed accounts pertaining to the type specimens have been prepared, and these may be expected to appear at a later date.

Emoia murphyi, new species

Type Specimen.—A. M. N. H. No. 41740; Salailua, Savaii Island, Samoan Group; collected by the Whitney South Sea Expedition; young.

Distribution.—Known only from the type locality.

Diagnosis.—A species closely allied to *E. samoensis*, differing chiefly in having 84 lamellæ under the fourth toe of the hind foot instead of 77 or less; 54 scales from the occiput to the base of the tail; 30 scales around the middle of the body; four supraoculars; dull grayish-olive above, darker posteriorly, with a few ill-defined dark and light spots present, particularly on the dorsolateral region; light blue below.

Measurements of the Type Specimen.—Total length, 205 mm.; tip of snout to vent, 73 mm.; tip of snout to anterior border of ear, 18 mm.; width of head, 12 mm.; front leg, 24 mm.; hind leg, 36 mm.

Named for my colleague, Dr. Robert Cushman Murphy, Curator of Oceanic Birds at The American Museum of Natural History.

Emoia whitneyi, new species

Type Specimen.—A. M. N. H. No. 44005; Shortland, Solomon Islands; collected by the Whitney South Sea Expedition; young.

Distribution.—Known only from the type locality.

Diagnosis.—A species closely allied to *E. tropidolepis* (Boulenger) of New Guinea, differing chiefly in the possession of more keels on the dorsal scales (five to seven instead of two to five, usually three) many of which are incomplete, vestigial or broken, instead of prominent, continuous and unbroken as shown in Boulenger's type illustration; 32 scales around the middle of the body (not 34 to 36); 33 lamellæ under the fourth toe of the hind foot; and (if Boulenger's type illustration is correct) 63 scales from the occiput to the base of the tail (not 46). There are four supraoculars and the ground color is brownish above, darker laterally, but light below.

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[1] Three previous contributions to this series have appeared without numbers. These may be cited as follows: I. Schmidt, Karl P., 1921, 'A List of the Lizards Collected by R. H. Beck in the Southern Pacific, November, 1920, to May, 1921,' Copeia, CI, pp. 90–92; II. Schmidt, Karl P., 1922, 'Second Report on Lizards Secured by the Whitney South Sea Expedition,' Copeia, CIV, pp. 23–24; III. Ortenburger, A. I., 1923, 'Further Notes on Lizards Collected by the Whitney South Sea Expedition,' Copeia, CXVII, pp. 59–60.

Measurements of the Type Specimen.—Total length (undetermined), over 62 mm.; tail (broken), over 22 mm., the length of the stub; tip of snout to vent, 40 mm.; tip of snout to forelimb, 18 mm.; tip of snout to anterior border of ear, 11 mm.; width of head, 5.5 mm.; front leg, 14 mm.; hind leg, 22 mm.

Named for Mr. Harry Payne Whitney, whose support of the notable expedition which bears his name has resulted in the finding of all the new species described at this time.

Sphenomorphus taylori, new species

Type Specimen.—A. M. N. H. No. 42018; Bougainville, Solomon Group; collected by the Whitney South Sea Expedition; an adult male.

Distribution.—Known only from the type locality.

Diagnosis.—Apparently a very distinct species, differing from the described forms of *Sphenomorphus*, and *Parotosaurus*, in the possession of the following combination of characters: five to seven supraoculars; two or more superimposed anterior loreals; numerous shields between the eye and the anterior loreals, just mentioned; supranasal plate present or absent; two frontoparietals; an interparietal; ear opening large, no lobules; scales smooth; two enlarged preanals; 53 to 55 scales around the middle of the body; 114 to 118 scales from the occiput to the base of the tail; 31 to 35 lamellæ under the fourth toe of the hind foot. Uniform dark brown above, obscurely mottled with transverse light markings on the sides; throat, upper chest, and under surface of tail uniform dark brown, but lighter than above, however; other ventral parts yellowish brown, with dark brown patches or spots.

Measurements of the Type Specimen.—Total length, 327 mm.; tip of snout to vent, 147 mm.; tip of snout to forelimb, 60 mm.; tip of snout to anterior border of ear, 30 mm.; width of head, 19 mm.; fore leg, 39 mm.; hind leg, 52 mm.

Paratype.—One specimen from the type locality.

Named for my friend, Dr. Edward H. Taylor, in appreciation of his splendid contributions to oriental herpetology.

Tribolonotus blanchardi, new species

Type Specimen.—A. M. N. H. No. 43922; Choiseul, Solomon Islands; collected by the Whitney South Sea Expedition; young.

Distribution.—This form is apparently confined to the Solomon Islands where it occurs in a number of localities.

Diagnosis.—A species easily distinguished from the forms of *Tribolonotus* inhabiting New Guinea (*novæ-guineæ* and *gracilis*) in having over twenty scales from the occiput to the base of the tail instead of about a dozen, not to mention other variations; and from *schmidti*, described below, in the possession of but a single longitudinal row of large mid-dorsal plates instead of a double one. The type specimen has four supraoculars; two large preanal shields; eight longitudinal series of large ventral plates at the middle of the body, all unicarinate; 43 scales from the preanal region to the large chin-shields; 32 large scales from the occiput to the base of the tail; one longitudinal row of large dorsal scales, this forking anteriorly just behind the occiput; and 22 lamellæ under the fourth toe of the hind foot.

MEASUREMENTS OF THE TYPE SPECIMEN.—Total length, 78 mm.; tip of snout to vent, 32 mm.; tip of snout to forelimb, 14 mm.; tip of snout to anterior border of ear, 7 mm.; width of head, 4 mm.; fore leg, 8 mm.; hind leg, 12 mm.

PARATYPES.—Two specimens from islands in the Solomon Group.

Named for my former teacher, Dr. Frank N. Blanchard, in appreciation of his well-known and excellent contributions to herpetological science.

Tribolonotus schmidti, new species

TYPE SPECIMEN.—A. M. N. H. No. 41860; Beagle, Solomon Islands; collected by the Whitney South Sea Expedition; young.

DISTRIBUTION.—This form is apparently confined to the Solomon Islands where it occurs in a number of localities.

DIAGNOSIS.—A species easily distinguished from the forms of *Tribolonotus* inhabiting New Guinea (*novæ-guineæ* and *gracilis*) in having over twenty scales from the occiput to the base of the tail instead of about a dozen, not to mention other variations; and from *blanchardi*, described above, in the possession of a double row of large vertebral plates instead of but a single one. The type specimen has four supraoculars; two large preanal shields; eight longitudinal series of large ventral plates at the middle of the body; 35 scales from the preanal region to the large chin-shields; two longitudinal series of much enlarged dorsal scales; irregular-sized lateral scales, some granular, some enlarged; 29 scales from the occiput to the base of the tail; and 20 lamellæ under the fourth toe of the hind foot.

MEASUREMENTS OF THE TYPE SPECIMEN.—Total length, 88 mm.; tip of snout to vent, 39 mm.; tip of snout to forelimb, 16 mm.; tip of snout to anterior border or ear, 11 mm.; width of head, 7 mm.; front leg, 9 mm.; hind leg, 14 mm.

PARATYPES.—Two specimens from islands in the Solomon Group.

Named for my friend, Mr. Karl P. Schmidt, in appreciation of his excellent researches pertaining to the zoögeography of the reptiles.

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A KEY TO ATLANTIC SPECIES OF THE GENUS *CYPSELURUS*, WITH A NEW FLYING-FISH FROM THE CLEVELAND MUSEUM'S 'BLOSSOM' EXPEDITION

By J. T. Nichols and C. M. Breder, Jr.

Two specimens of the genus *Cypselurus* from the Atlantic, collected by the 'Blossom' Expedition of the Cleveland Museum, 1923–1926, have been courteously turned over to us for study. One seems to represent an undescribed form, the other, *Cypselurus lineatus*, a little-known species. In comparing them with other material, as well as with world literature, sufficient data has been accumulated to enable us to construct a key to Atlantic Ocean species of the genus. We believe we have now examined all described and recognizable forms of *Cypselurus* from that region.[1]

Cypselurus bahiensis (Ranzani)

For purposes of comparison, we have drawn up a description of a specimen of *Cypselurus bahiensis* from the Bingham Oceanographic Collection (No. 124, Caribbean Sea), as follows:

Length to base of caudal, 230 mm. Depth in this length, 5.4; head, 4.2; pectoral, 1.3; ventral, 3.6. Eye in head, 3.3; snout, 3.6; interorbital, 2.8; maxillary, 4; width of head, 2; width of body, 1.8; depth of peduncle, 3.2; dorsal base, 1.4; anal base, 2.2; longest dorsal ray, 2.7; longest anal ray, 4.2; lower caudal lobe 0.8 (est.; broken). Anal base in dorsal base, 1.5.

Dorsal, 13½; anal, 11½. Lateral line, 55; predorsal scales, 37.

The pectoral reaches to the origins of the caudal; ventral to base of ninth anal ray; its insertion being midway between base of caudal and middle of opercle, or midway between last anal ray and middle of pectoral base. Dorsal origin at two-thirds the distance from middle of preopercle to caudal base; anal origin behind dorsal origin by about the diameter of eye.

Cypselurus minos, new species

Description of Type.—No. 72, Blossom South Atlantic Expedition; from Mindelo, St. Vincent, Cape Verde Islands, purchased December 21, 1923.

Length to base of caudal, 335 mm. Depth in this length, 6.4; head, 4.7; pectoral, 1.6 (est.; the fins are broken); ventral, 3.8 (est.). Eye in head, 3.8; snout,

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[1] Amer. Mus. Nat. Hist., 5 species; Bingham Oceanographic Mus., 2 species; Cleveland Mus., 2 species.

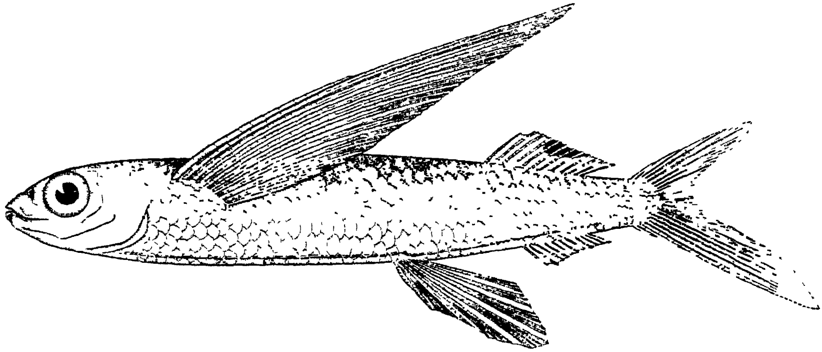

Fig. 1. *Cypselurus bahiensis* (Ranzani). Specimen 230 mm. standard length, No. 124, Bingham Oceanographic Collection.

3.3; interorbital, 2.6; maxillary, 4.4; width of head and of body, 1.8; depth of peduncle, 3.8; dorsal base, 1.4; anal base, 2; longest dorsal ray, 2.2 (est.); longest anal ray, 2.8 (est.); lower caudal lobe, 0.9 (est.). Anal base in dorsal base, 1.5.

Dorsal, 11; anal, 9½. Lateral line, 65±; predorsal scales, 38. Jaw teeth conic, scarcely or not at all curved, monocuspid; lower jaw teeth not as acutely pointed as upper; no palatine teeth.

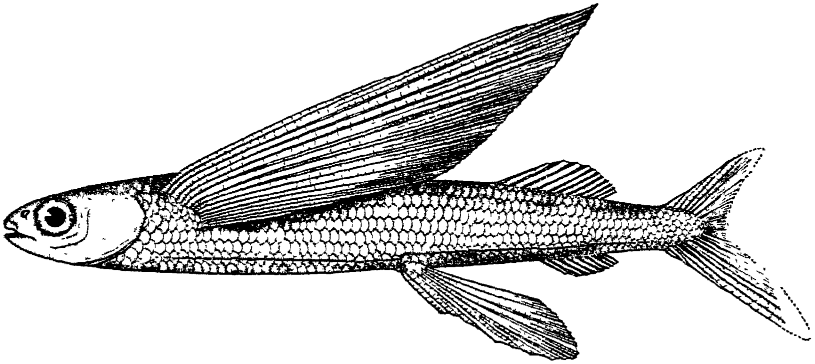

Fig. 2. *Cypselurus minos*, new species. Type, 335 mm., standard length.

Head broad and flat above; snout pointed for a *Cypselurus;* mouth very small. Second pectoral ray divided; fin (broken) reaching to at least last dorsal ray; ventrals reaching to base of last anal ray, inserted midway between base of caudal and middle of opercle, and midway between base of last anal ray and axil of pectoral; dorsal origin at two-thirds the distance from middle of opercle to caudal base; anal origin behind dorsal origin by a distance slightly less than diameter of eye.

Color in alcohol, dusky above, lighter below. Pectorals uniform dusky with a small light spot or bar near middle of last rays; ventrals uniform dusky; anal grayish.

This species is related to *C. bahiensis* and would be referred to same on the basis of current "keys"; see, however, our analysis of Atlantic species of the genus (p. 5) for the differences. Because of the lack of a good figure of true *C. bahiensis*, one is given here (Fig. 1) for purposes of comparison. It is based on material of the Bingham Oceanographic Collection.[1]

Cypselurus lineatus (Cuvier and Valenciennes)

A large specimen of this little-known species, with type-locality in West Africa and also recorded from Bermuda, is described below. Very likely it comes from the Cape Verde Islands also, but unfortunately the accompanying data has been lost.

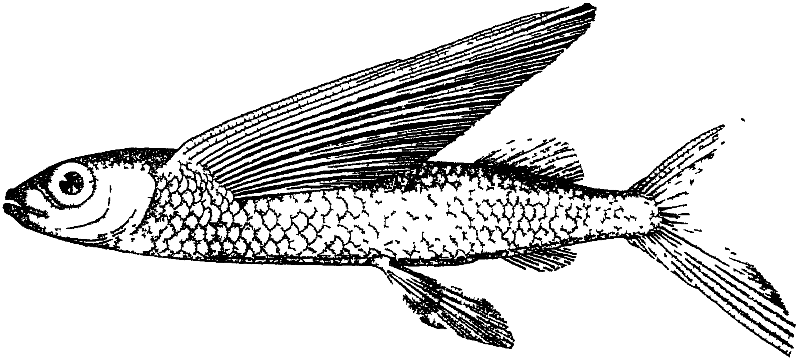

Fig. 3. *Cypselurus lineatus* (Cuvier and Valenciennes). Specimen 350 mm., standard length.

Length to base of caudal, 348 mm. Depth in this length, 5.8; head, 4.3; pectoral, 1.5; ventral, about 4. Eye in head, 3.4; snout, 3.2; interorbital, 2.6; maxillary, about 3.4; width of head, 1.7; width of body, 1.6; depth of peduncle, 3.7; dorsal base, 1.5; anal base, 2.2; longest dorsal ray, 3.1; longest anal ray, 3.8; lower caudal lobe (est.; broken), 0.8; anal base in dorsal base, 1.5.

Dorsal, 11½; anal, 10. Lateral line, about 60; predorsal scales, about 37. Jaw teeth long and slender, with sharp, curved tips, monocuspid; teeth of lower jaw slightly longer, and more curved than upper: palatine teeth present.

Head broad and flat above; snout pointed for a *Cypselurus*, but less pointed than in *C. minos*. Second pectoral ray divided; fin reaching to the depressed last ray of dorsal; ventrals reaching to the first third of anal base; inserted midway between base of caudal and middle of preopercle; and midway between base of last anal ray and first third of pectoral base. Dorsal origin at two-thirds the distance from middle of eye to caudal base; anal origin behind dorsal origin by a distance about equal to the diameter of eye, and a little nearer ventral insertion than to base of caudal.

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[1] Breder, 1927, Bull. Bing. Oceanographic Coll., I, Art. 1, p

Color in alcohol: dusky above, lighter below, sides and belly with light dotted lines along each scale row. These are decidedly more prominent than in any other species of the genus known to us, and are formed of pearl-gray spots, one to a scale, on a darker ground color. Pectorals pale at inner edge, otherwise dusky; ventrals with an irregular blackish bar or blotch at inside edge proximal to middle of fin which is grayish, paling distally. Dorsal, anal, and caudal uniform dusky.

TEETH OF ATLANTIC SPECIES OF *Cypselurus*

With the figures of jaw teeth given in Breder and Nichols,[1] and those shown in Fig. 4, the teeth of all Atlantic *Cypselurus* have been illustrated. The following figures complete the accompanying tabular data given in the above-mentioned paper, which see.

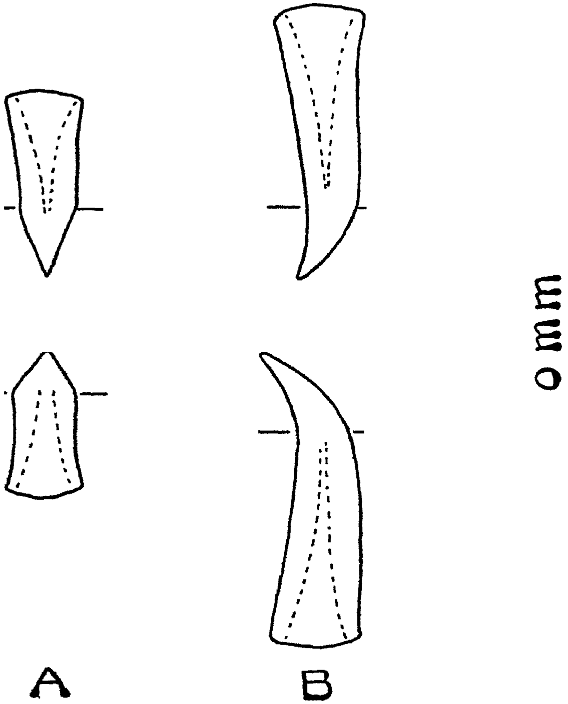

Fig. 4. Jaw teeth of (A) *Cypselurus minos* and (B) *Cypselurus lineatus*. Microscope sketches.

	U.	L.	S.L.	Ratio
Cypselurus lineatus	.75	.80	350	0.00221
" *minos*	.50	.40	335	0.00134

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[1] Breder and Nichols, 1930, Amer. Mus. Novitates, No. 417, p 8, Fig. 5

KEY TO ATLANTIC SPECIES OF THE GENUS *Cypselurus*

I. (*Cypselurus*). Second pectoral ray divided; third and fourth longest; muzzle not especially broad and short.

A. Jaw teeth with distinct cusps, bicuspid or tricuspid; vertical fins without pattern; ventral insertion midway between caudal base and eye, or near eye; no barbels.

B. Ventral insertion midway between base of caudal and a pupil's diameter behind eye; pectoral pale, without pattern; tooth ratio, 0.00165; teeth tricuspid. . . . . *vitropinna*.

BB. Ventral insertion midway between base of caudal and middle or posterior margin of eye; pectoral, dusky or patterned.

C. Base of anal, two times in base of dorsal; tooth ratio, 0.00068; teeth bicuspid. . . . . *lutkeni*.

CC. Base of anal, one and two-third times in base of dorsal; tooth ratio, 0.00060; teeth tricuspid. . . . . *heterurus*.

AA. Jaw teeth without distinct lateral cusps, monocuspid; vertical fins with or without pattern; barbels present or absent.

D. Mandibular barbels present; pectorals or ventrals, or both, with a definite pattern; anal base, 1.5 in dorsal base.

E. Barbels short and membranous, dark-colored; both pectorals and ventrals with a broad white cross-bar on a dark field (mottled in the young), vertical fins plain; dorsal low; ventral insertion midway between base of caudal and center of eye; tooth ratio, 0.00090. . . . . *furcatus*.

EE. Barbels long, with a light-colored, central rib edged on either side by dark fluting; pectorals black, ventrals with the distal one-third abruptly black, dorsal nearly all black, anal with a black spot and caudal mottled; dorsal high; ventral insertion midway between base of caudal and edge of preopercle; tooth ratio, 0.00211. . . . . *monroei*.

DD. No mandibular barbels.

F. Upper caudal lobe whitish, lower blackish; posterior part of dorsal abruptly black; pectorals dark; ventrals inserted midway between base of caudal and posterior margin of eye; tooth ratio, 0.00132. . . . . *smithi*.

FF. Both caudal lobes dusky, paired fins with indistinct pattern, if any, dorsal not abruptly black posteriorly; ventral insertion midway between base of caudal and some point behind eye.

G. Sides and belly without distinct rows of pale spots; ventral insertion midway between base of caudal and middle of operculum.

H. Dorsal fin with a roundish dark blotch; inserted at one-third the distance from base of caudal to middle of preoperculum; ventral insertion midway between base of caudal and middle of operculum; tooth ratio, 0.00246. . . . . *bahiensis*.

HH. Dorsal fin plain dusky, inserted at one-third the distance from base of caudal to middle of opercle; ventral insertion midway between base of caudal and middle of opercle; tooth ratio, 0.00134. . *minos*.

GG. Sides and belly with distinct rows of pale spots; ventral insertion midway between base of caudal and margin of preopercle; tooth ratio, 0.00221. . . . . *lineatus.*

II.—(*Prognichthys*[1]). Second pectoral ray simple, third divided, fourth and fifth longest; muzzle broad and short. . . . . *gibbifrons.*

This key cannot be considered as fully expressing the phylogenetic relationships of the forms treated, which relationships are as yet but vaguely understood. However, it succeeds in assembling the nine species into three groups, each of which is characterized by certain structural elements which are evidently expressions of genetic affinity. The first three (*lutkeni, vitropinna* and *heterurus*) all have distinct secondary cusps on the jaw teeth, while the rest have monocuspid teeth; and their fins have a certain simplicity of pattern shared by the third group. Fishes of the second group (*furcatus* and *monroei*) show complicated and ornate fin patterns, remain at a permanently small size, and possess barbels throughout life. The third group (*smithi, bahiensis, minos,* and *lineatus*) agrees with the first in matter of pattern, except *smithi* which approaches the second in this respect and may be permanently a small fish. The others attain the largest size of Atlantic *Cypselurus,* and all differ from the first group in having monocuspid jaw teeth.

These differences and similarities (of adult material) may be set forth as follows:

SIZE	Medium.	Small.	Large
WING PATTERN	Plain.	. . . Elaborate.	Plain
TEETH	With Cusps	Without Cusps	
BARBELS	None[2]	Present	None
SPECIES	*lutkeni, heterurus, vitropinna*	*furcatus, monroei*	*smithi, minos, bahiensis, lineatus*

SYNONYMY

Cypselurus lutkeni (Jordan and Evermann)

Exocoetus lutkeni JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., XLVII, part 1, p. 736. Cuba.

Exocoetus robustus JORDAN AND MEEK, 1886, Proc. U. S. Nat. Mus. for 1885, VIII, p. 61. Cuba. Probably not of Günther, 1866, 'Cat.,' VI, p. 289. Australia.

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[1] Breder, 1928, Bull. Bing. Oceanographic Coll., II, Art. 2, p. 20, which see. Should perhaps stand as a subgenus, but is sufficiently distinct from the species herein discussed to warrant omission from this analysis.

[2] This group may possibly have barbelled young, such having been described for *heterurus*.

Cypselurus vitropinna Breder

Cypselurus vitropinna BREDER, 1927, Bull. Bingham Oceanog. Mus., I, Art. 1, p. 20, Fig. 1. West Indies.

Cypselurus heterurus (Rafinesque)

Exocoetus heterurus RAFINESQUE, 1810, 'Caratteri di Alcuni Nuov. Gen., etc.,' p. 58. Palermo. JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., XLVII, part 1, p. 735. Atlantic Ocean, both coasts.

Exocoetus comatus MITCHILL, 1815, Trans. Lit. and Phil. Soc. N. Y., p. 448, Pl. V, fig. 1. New York. Apparently a young form, with long mental barbel.

Exocoetus noveboracensis MITCHILL, 1814, Amer. Monthly Mag., II, p. 233. New York.

Exocoetus appendiculatus WOOD, 1824, Journ. Acad. Nat. Sci. Phila., p. 283, Pl. XVII, fig. 24. Southeast coast United States (young).

Exocoetus melanurus CUVIER AND VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 101. New York.

Cypselurus lutkeni SMITH, 1907, 'Fishes North Carolina,' p. 167, Fig. 66; not of Jordan and Evermann, 1896, or Breder and Nichols, 1930.

Cypselurus furcatus (Mitchill)

Exocoetus furcatus MITCHILL, 1815, Trans. Lit. and Phil. Soc., N. Y., I, p. 149, New York (young).

Exocoetus nuttalli LE SUEUR, 1821, Journ. Acad. Nat. Sci. Phila., p. 10, Pl. IV, fig. 1. Gulf of Mexico.

Exocoetus (*Cypselurus*) *procne* DE FILIPPIE VERANY, 1857, Mem. Acad. Sci. Torino, (2) XVIII, p. 10. Nice.

Exocoetus maculipinnis VINCIGUERRA, 1883, 'Risult. ittiol. del Violante,' p. 113, Pl. I, fig. 6. Tunis.

Exocoetus nigricans BENNETT, 1840, 'Whaling Voyage,' II, p. 287. In part (tropical Atlantic).

Exocoetus spilopus CUVIER AND VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX p. 118. La Rochelle; St. Helena; West Indies; India; Arabia; DeWitt Land.

Cypselurus monroei Nichols and Breder

Cypselurus monroei NICHOLS AND BREDER, 1928, Zoologica, VIII, No. 7, p. 432. Fig. 167. Florida.

Cypselurus smithi Breder and Nichols

Cypselurus smithi BREDER AND NICHOLS, 1930, Amer. Mus. Novitates, No. 417, p. 4, Fig. 3. North of Bahamas.

Cypselurus bahiensis (Ranzani)

Exocœtus bahiensis RANZANI, 1842, Nov. Comm. Ac. Sci. Inst. Bonon., V, p. 362, Pl. XXXVIII. Bahia.

Exocoetus vermiculatus POEY, 1861, 'Memorias,' II, p. 300. Cuba.

Exocœtus parra POEY, 1868, 'Synopsis,' p. 385. Cuba. Insufficient description.

Exocœtus cyanopterus CUVIER AND VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 98. Bahia; Rio de Janeiro.

Exocœtus albidactylus GILL, 1863, Proc. Acad. Nat. Sci. Phila., p. 167. Caribbean Sea (erroneously ascribed to Panama).

Cypselurus minos Nichols and Breder

Cypselurus minos NICHOLS AND BREDER, 1930, Amer. Mus. Novitates, No. 428, p. 1, Fig. 2. Cape Verde Is.

Cypselurus lineatus (Cuvier and Valenciennes)

Exocœtus lineatus CUVIER AND VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' XIX, p. 92. Gorée; Canaries. GOODE, 1876, Bull. U. S. Nat. Mus., V, p. 76. Bermudas.

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PRIMATES AND PANGOLINS FROM THE ASIATIC EXPEDITIONS[1]

BY GLOVER M. ALLEN

In their natural distribution, the species of primates occurring in China are confined to the southern half of that country south of the latitude of about 30° north. Nevertheless, as in the Moupin district of Szechwan, they may attain a considerable altitude in the mountains, though perhaps this may be affected by the seasonal temperature. The pangolins are also essentially southern, but in their case, it seems highly probable that their northward range must be in large part dependent upon the presence or absence of the species of termites upon which they depend for food. Of the primates secured by the Asiatic Expeditions, the excellent series of rhesus monkeys shows that but a single species occurs across southern China, in spite of various names applied by writers down to the time of Elliot. The status of several of the described races of stump-tailed macaque is also open to question, though adequate material for a final opinion is not yet available. The hoolock gibbon is now definitely added to the Chinese fauna as well as a third species of langur. Of the rare snub-nosed monkey, no specimens were secured.

PRIMATES

Macaca mulatta (Zimmermann)

Cercopithecus mulatta ZIMMERMANN, 1780, 'Geogr Gesch d Mensch.,' II, p 195.

Hinton and Wroughton (1921) have lately shown that the name *rhesus*, by which the rhesus monkeys had so long been known, is antedated by *mulatta* of Zimmermann, based on Pennant's tawny monkey of India. Except for a doubtfully distinct race, *villosa*, from Kashmir, there is currently believed to be but the single typical form in India, so that three skins from Teng-yueh, western Yunnan, secured by Dr. R. C. Andrews, may be regarded as the same. These, in somewhat worn pelage of late April, are ochraceous olive on the head, with a tuft of black hairs on the forehead between the eyes. Posteriorly the ochraceous element increases in intensity, pale across the shoulders, brighter to nearly fulvous on the lower back and oustide of thighs, the fur everywhere with long gray bases, especially prominent on the long hair of the shoulders; the feet and lower limbs are drab gray, with faint ochraceous wash. The lower surface is pale grayish white. Tail about half the length of the trunk, colored above like the back, buffy gray below.

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This monkey occurs across China from Yunnan and southern Szechwan to the coast near Shanghai, and thence south to Hainan and Cochin China. There is also an isolated colony in the former hunting park of Eastern Tombs, east of Peking in Chihli Province, on a specimen from which Milne-Edwards, in 1870, based the name *Macacus tcheliensis*, supposing it to have a shorter tail than the rhesus of India. Six specimens, mostly immature, from this locality were secured by the Asiatic Expeditions, and a careful comparison reveals no character by which they may be certainly distinguished from those of southern China. Obviously this colony must be regarded as derived from individuals introduced, no doubt many years ago, for the Chinese frequently keep this species in captivity. Elliot places the name as a synonym of Gray's *Macacus lasiotus*, said to have come from Szechwan. A skin in the Museum of Comparative Zoölogy from Nachukar, western Szechwan, at 10,000 feet, should represent this latter, but it is indistinguishable, even in length of hair, from other South-China individuals representing *mulatta*, nor does Milne-Edwards's *Macacus vestitus* from southeastern Tibet appear to be different, except possibly in slightly longer pelage.

The collections of The American Museum of Natural History further include a small series of these monkeys from Kuatun, Fukien Province, and others from the island of Hainan, which again show no points of difference in comparison with rhesus monkeys from western China. Thomas also has referred Indo-Chinese specimens to typical *mulatta*. It follows that Swinhoe's *Inuus sancti-johannis*, based on a very young rhesus in alcohol from a small island near Hongkong, as well as Elliot's *Pithecus littoralis* from Kuatun, are likewise synonyms of *mulatta*. Elliot also named as a distinct species, *Pithecus brachyurus*, the rhesus of Hainan, later changing the specific name to *brevicaudus*, since he regarded *brachyurus* as preoccupied by Temminck's *Macacus brachyurus* for the pig-tailed macaque. The distinctions he drew were made between two male skulls, one from India, the other from Hainan, but these do not seem to be more than individual or age peculiarities, for in the series from Hainan, secured by Mr. Clifford Pope, I can find no reliable points of difference in comparison with other individuals from the mainland. In a series of wild-killed specimens, there is a very great amount of cranial variation, partly of age, partly of sex, and in part individual. The skulls of young animals have very short snouts, giving a facial angle of nearly 70°, and the forehead rises well above the eyebrow ridges when viewed from the front. With increasing age, the rostrum becomes longer and there is a distinct forward displacement of the teeth, so that whereas in a young one with only the two premolars in place the second is directly below the anterior root of the zygoma, in a skull with two molars erupted, the FIRST of these occupies that position, and in an old animal, the SECOND molar is directly below the zygomatic root, and the facial angle is only 45°. The increasing boniness of the eyebrow ridges results in a gradual flattening of the dorsal outline of the skull as seen from in front, changing the evenly rounded arc to a slight upward bulge, with but little of the top of the skull appearing above the ridges.

Macaca assamensis (McClelland)

Macacus assamensis McCLELLAND, 1839, Proc. Zool. Soc. London, p. 148.

A monkey with the general appearance of a rhesus, but lacking the yellow and orange tones of color; instead, it is a nearly uniform yellowish brown above, gray below.

Hinton and Wroughton (1921) have shown that this is a species distinct from *M. mulatta*, with a somewhat restricted distribution in northeastern India and the extreme southwest of China. Anderson, in his 'Zoological Researches' (1879), long ago found it on the Yunnan border. Two specimens were secured by Dr. R. C. Andrews on the Namting River, western Yunnan, in March, 1917.

Lyssodes speciosus melli (Matschie)

Macacus (Magus) arctoides melli MATSCHIE, 1912, Sitzungsb. Ges. Naturf. Freunde, Berlin, p. 308.

The stump-tailed macaques of southeastern Asia, ranging from Tenasserim and Upper Burma to Cochin China and Fukien Province, obviously comprise a single specific type to which many names have been applied, the oldest of which, as shown by Elliot, in 1912, is *Macacus speciosus* of F. Cuvier, based on a drawing by Duvaucel, whose subject is conjectured to have come from somewhere in the area mentioned. The animal of Tenasserim appears to be a brightly colored race, with the outer side of the limbs reddish, *rufescens* of Anderson; while from the mountains between Cambodia and Siam, Trouessart in 1892 described *Macacus harmandi*, which, as Elliot suspects, is probably a synonym of *speciosus.* In 1870, Milne-Edwards described a representative of this macaque from the mountainous district of Moupin, in Szechwan, giving it the name *Macacus thibetanus.* He mentions its dark grayish-brown color, non-annulated hairs, the flesh-colored face and hands, while his plate shows a slightly golden-brown forehead, and gray cheeks. In the lack of typical specimens for comparison, it may stand as a subspecies of *speciosus.* More recently, Pocock had advocated the generic distinctness of the stump-tailed macaques including the Japanese *fuscatus,* in part on important differences in the glans penis.

Finally, both Matschie, in 1912, and A. B. Howell, in 1928, have applied new names to the dark chocolate-brown animal of southeastern China, which again may not be very different from true *speciosus.* Matschie had two specimens, both males, sent from Canton by Mell to the Berlin Zoölogical Gardens. They were secured in the mountains west of Lo-chang-ho, near the western border of Kwangtung Province. The face may be either red or flesh-colored, and though both types occur together, Matschie proposed to regard them as two distinct species, naming the one *melli,* the other *esau,* the former of which should be used as the valid name for this race.

The Third Asiatic Expedition secured five specimens in northwestern Fukien, near Kuatun, the type-locality of *Pithecus pullus* Howell (undoubtedly a synonym of *melli*). They are nearly uniform chocolate brown on head, body and limbs, paler below and on the sides of the head. The hair radiates from a central spot or line on the crown.

Pithecus obscurus barbei (Blyth)

Presbytis barbei Blyth, 1847, Journ. Asiatic Soc. Bengal, XVI, p. 734.

A beautiful series of eleven adults and two young "leaf monkeys" is tentatively referred to Blyth's *barbei,* here regarded as a subspecies of the darker *obscurus* of Siam, of which it is obviously a close relative. All the specimens are from extreme southwestern Yunnan, three from Homushu Pass, the others from the Namting River. The adults of both sexes are alike, of a general silvery gray with blackish face and forehead, and blackish-brown feet. Across the forehead the long black hairs stand stiffly erect; those of the sides and crown of the head do not form a crest but are directed backward. The color becomes drab-gray on the crown, paler buffy gray on the nape, and silvery gray on the back, flanks, and upper parts of the limbs and the tail, faintly washed across the shoulders with pale buff; the greater part of the forearm and the hands and feet are contrastingly dark, almost blackish; chin and a few hairs on upper lip medially, whitish; lower surface of body and upper arms pale silvery gray; tail silvery gray darkening slightly at the tip; face covered with short, scattered, black hairs. Individuals show some slight variation in the amount of buffy wash over the upper back.

A very young specimen taken on March 6 is entirely fulvous, except the tail which is slightly darkened with dusky hairs. A somewhat older animal, hardly larger, has lost this youthful coat and is uniform dusky gray with blackish feet, except that the tail still retains a considerable fulvous tinge.

Though obviously a member of the *obscurus* group, with crestless head, generally dark-gray body, and blackish feet, and having a fulvous coat in the baby stage, it is nevertheless somewhat uncertain which of the various published names should be applied to this monkey; but, in the absence of comparable material, I am referring it to *barbei*, originally named from the Tippera Hills, eastern India (not from Tenasserim, as Anderson showed), with the description of which it seems to agree closely. Possibly, however, it should be called *crepusculus* Elliot, the name which Thomas has used for specimens from Annam and Cambodia. The type-locality of the latter is Mt. Muleyit in Tenasserim, a district which Elliot also includes in the range of *obscurus*, whose type-locality seems to be not definitely known. Nor do the descriptions of *P. germaini*, *phayrei*, *margaritæ*, and *shanicus* read essentially different. *P. melamera* Elliot, type-locality Bhamo, Burma, is said to differ by having the legs uniformly sooty. Anderson, in 1879, recorded *barbei* from the Kakyen Hills, northeastern Burma, but the present seems to be the first definite record for China. One other species, *P. françoisi*, is recorded from Kwangsi Province, black with a white temporal band; while in Hainan occurs *Pygathrix nemæus*, now regarded as generically separate from *Pithecus*.

Hylobates hoolock (Harlan)

Simia hoolock HARLAN, 1834, Trans. Amer. Phil. Soc., N. S., IV, p. 52.

In his recent review of the gibbons, Pocock (Proc. Zool. Soc. London, 927, p. 719) reduces the many nominal species to but three, of which two, *H. lar* of Lower Burma and Siam, and *H. hoolock* of Assam and Upper Burma, are obviously close relatives, while the third, *H. concolor* of Tonkin and Hainan, differs not only in lacking a pale eyebrow-band in the black phase, but in having an extremely long clitoris.

The known northeastern range of *H. hoolock* is now, apparently for the first time, extended into western Yunnan, through the capture of six specimens on the Namting River and at Homushu Pass, by Dr. R. C. Andrews as already recounted by him. The series shows the usual sexual dichromatism, for the two males are blackish brown, more nearly dark brown on the chest and across the shoulders, and have the usual whitish eyebrow-band which is narrowly interrupted by dark blackish brown between the eyes. The remaining specimens are marked females (except one, no doubt erroneously labelled a male), and are contrastingly pale in color. The hair of the face and encircling it is nearly clear white with a few stiff black hairs over the eyes; and the chin, hands, feet, and upper chest are also white. The rest of the body is soiled white, tinged with pale brown. One of the specimens, however, is much darker, nearly uniform drab-brown on body and limbs, with pale head and neck. Possibly the hoolock goes through changes similar to those of *H. concolor* and its races, in which, as reported by Delacour, both sexes are "yellow" in babyhood, soon turning black, in which state the male remains, while the adult female becomes pale again.

NOMARTHRA

Manis pentadactyla dalmanni Sundevall

Manis dalmanni SUNDEVALL, 1843, Kongl. Vet.-Acad. Handl., 1842, XIII, p. 278, Pl. IV, fig. 10.

The Chinese pangolin differs from the two species of eastern and southern India in its well-developed external ear, and in various other characters of size, color, proportions, and average scale-count, as reviewed by Pocock (Proc. Zoöl. Soc. London, 1924, p. 707). Thomas has shown that the type-locality of Linnæus' *M. pentadactyla* must be regarded as Formosa, whence Bontius in 1658 described and figured a specimen that afterwards became the basis of this name. In 1749, Dalmann published a good account of the Formosan pangolin, and its habits. He appears to have had two specimens, one of which he kept alive for a time. Nearly a century later, Sundevall named the mainland form of the eastern pangolin *Manis dalmanni,* giving as its habitat "China, prope Canton." He had but three specimens for study: a skin with rostrum, in the Stockholm Museum, which was apparently without label, for he says the specimen was seemingly the one forming the subject of Dalmann's account; a second specimen of unknown origin in the Copenhagen Museum; and a third in the Paris Museum obtained a few years before from China. It seems likely that this last was the only one with a definite locality, and in view of Sundevall's express statement that the name *dalmanni* applies to the mainland form, near Canton, it seems inadmissible to make it a synonym of the Formosan *pentadactyla,* as Matschie has done in erecting the new name *kreyenbergi* (type-locality, Nanking) for the South China animal. The latter, according to Swinhoe, is constantly smaller than the typical form from the island of Formosa, so that in lack of evidence to the contrary it may be tentatively regarded as a distinct race. It is certainly much smaller of body and skull than the Hainan pangolin, as shown by the excellent series from that island secured by Mr. Clifford H. Pope. Fukien skulls average about 74 mm. in basal length against 82 for the Hainan series. The differences in scale-counts between island and mainland specimens pointed out by Matschie prove to be matters of individual variation. In adult skulls the zygomatic processes of maxillary and squamosal frequently unite by prolongation of their tips, but in a few specimens by the ossification of a distinct small bone, which may represent the jugal or a connecting ossified cartilage.

Manis pentadactyla pusilla J. A. Allen

Manis pusilla J. A. Allen, 1906, Bull. Amer. Mus. Nat. Hist., XVIII, p. 465.

This island race was characterized on the basis of three specimens, only one of which was old, from Hainan. While it is said to be "very small," no direct comparison appears to have been made with specimens of the Formosan or mainland races. In the fine series secured from Hainan by Mr. C. H. Pope, however, there are eight adult skulls, which not only average larger than the Fukien series, but have longer tubular palates, with wider interpterygoid fossæ. They seem to be about equal in size to the Burmese skull figured by Anderson, but may for the present be regarded as representing a distinct animal.

by the fact that Père Heude, in a series of papers, proposed various names based on slight individual or minor variations, often creating several "species" from skulls collected in a single locality with little regard for differences of age, sex, or individuality. Lydekker, in his 'Catalogue of Ungulate Mammals' (1915), ignores the greater part of these, but Sowerby two years later, 1917, made a laudable attempt to review Heude's work from a study of the original specimens preserved in the Sikawei Museum at Shanghai, and succeeded in reducing the eighteen "species" of Chinese pigs to five. In again reviewing the whole matter in the light of the material collected by the Asiatic Expeditions, I find myself to some extent in disagreement with Sowerby's conclusions as to the proper names to be employed, yet it must be admitted that the following determinations are at best merely tentative.

Sus scrofa ussuricus Heude

Sus ussuricus Heude, 1888, Mém. concern. l'Hist. Nat. de l'Emp. Chin., II, p. 54, Pl. xvii, fig. 1. Ussuri Valley.

A single immature female, taken August 27, 1919, sixty miles northeast of Urga, Mongolia, is provisionally referred to this race. The locality is near the edge of the wooded country that borders the northern part of the Gobi Desert, to the south of which the forest-living species do not occur until favorable conditions reappear on the other side in northern China. In its coloration the specimen agrees more or less with the description of typical *Sus scrofa* of western Europe. The neck and body are a general pale gray-brown, the long coarse hairs having extensive whitish bases and pale-brown or drab tips. On the shoulders the hair in the midline is longer, forming a drab crest with very little intermixture of white; the forehead and cheeks are mixed dark brown and whitish; the backs of the ears, and a small patch behind the snout, are dark brown, the ears with white hairs along the anterior rim. The chin is also dark brown and this color extends back as a narrow line to the axilla, separating a white mustachial line behind the angle of the mouth from the white area of the throat, where the direction of the hairs is reversed. Both fore and hind feet are dark brown to the hoofs, blending above with the general color of the body, and the tail terminates in a tuft of long, blackish-brown hairs. There is an abundant growth of fine woolly hair, pale brown in color, at the base of the longer hairs. In its pale coloring this pig is very different from any of those from China, and in this respect is apparently like typical *S. scrofa*, from which it differs in the clearly defined white line at the angle of the jaw, characteristic of eastern pigs. The skull, though obviously immature, differs from all the Chinese specimens, and resembles those of Europe in the closer approximation of the temporal angles at the occiput, where they are only 26 mm. apart, a distance that would probably decrease with age.

It may be assumed that this pig is not very different from those of Manchuria, so that I have ventured to apply to it Heude's designation *ussuricus*, the type-locality of which is the Ussuri Valley in that country. He, however, named four other pigs from the same general region: *Sus canescens*, *S. gigas*, *S. songaricus*, *S. mandchuricus*; and Sowerby, in 1917, accepted *gigas* as the valid one of these. But, unfortunately, *gigas* was not published till 1892, in the second part of the monograph, while *ussuricus* occurs on p. 54 of the first part (1888) and, although mentioned in a preliminary way, is identifiable by a statement of the locality and a reference to the accompanying plate where part of the dentition is figured. It must, therefore. probably replace *gigas*. No doubt, also, Nehring's *Sus leucomystax continentalis*, published in 1889, is a synonym.

Sus scrofa moupinensis Milne-Edwards

Sus moupinensis Milne-Edwards, 1871, Nouv. Arch. Mus d'Hist. Nat , Paris, VII, Bull , p. 93. Moupin.

Milne-Edwards was the first to give a distinctive name to a Chinese pig. His type-specimen was a skin and skull collected by Père David in the district of Moupin, Szechwan Province, and was described as differing from *S. scrofa* of Europe in the shape of the skull, in which the forehead is markedly convex instead of nearly plane, and the occiput between the temporal fossæ is much wider. These differences, in addition to the usual presence of a paler (whitish or yellowish) line directed back from the angle of the mouth, seem, in general, distinctive of the Chinese pigs in comparison with those of Europe. Specimens from northern China, Shensi and Shansi, average paler in color and have more abundant under wool than those from Fukien collected by the Asiatic Expeditions, and the skulls, although otherwise practically identical, are very slightly wider across the forehead. It is a question, however, whether the Moupin pig more nearly resembles the Shansi and North China specimens or those of South China. A single female skull from Tachienlu, just west of Moupin (in the Museum of Comparative Zoölogy), may be regarded as typical of *moupinensis* and, since it has the broad forehead of the specimens from Shansi, I am following Sowerby in regarding the pigs of North

China and the western highlands as of this race. It is true, however, that pigs do not go to any great altitude in these mountainous regions, and it may turn out that typical *moupinensis* is the same as the animals of the Yangtse basin and southern China instead. In this case, Heude's name *dicrurus* is available for the northern pigs, first used in the 1888 paper (p. 55) for a pig from the upper Han River, Shensi, the teeth of which are figured in his plate 17. Heude also gave the names *oxydontus*, *laticeps*, and *curtidens* to pig skulls from this same area, the first of which is a *nomen nudum* in the 1888 paper; while the two latter do not appear until 1892, in the second part, where all four are illustrated by figures.

The small series of Shansi skins secured by the Asiatic Expeditions agree in being uniformly paler in coloration than the series from Fukien Province, and Howell records the same as true of the Chinese pigs in the U. S. National Museum. At least two distinct types of coloration occur: one in which the body is chiefly blackish with a sprinkling of white hairs; the other in which the body is chiefly ochraceous, more or less mixed with black. In both, the throat, lip stripe, and lining of the ears are white. There is a well-developed coat of fine woolly hairs hidden at the bases of the longer over-hairs, which is either lacking or scarcely developed in the pigs of southern China in summer.

Sus scrofa chirodontus Heude

Sus chirodontus Heude, 1888, Mém. concern. l'Hist. Nat. de l'Emp. Chin., II, p. 54. Kiangsi, Po-yang Lake.

The fine series of pigs secured in Fukien Province by members of the Asiatic Expeditions obviously differs from the North China series in the darker coloration. Some are practically all black with a suggestion of a pale line at the angle of the mouth, but most of them are of the "red" type in which the long hair is mixed black and deep rusty to maroon, only one of the series approaching the mixed ochraceous and whitish condition common to the North China skins. In addition, the fine wool at the base of the longer hair is lacking in the summer coat and but scantily developed at other seasons. The skulls of the two are barely distinguishable; those from Fukien average, however, slightly narrower across the forehead in proportion to their length.

The selection of the appropriate subspecific name for the pig of South China is again not so simple as first appears. Heude, in his 1888 paper, p. 54, first introduces *Sus chirodontus* with a statement that the elaborate description that follows is chiefly based on this species, which comes from the basin of Po-yang Lake. This statement is further accompanied by comparative notes concerning *S. chirodontus* and the extinct *S. erymanthius* Gaudry, so that the name as here first published is not a *nomen nudum*, as Sowerby must have believed when he employed Heude's *Sus paludosus* for the same animal. The latter name does not appear until 1892 (p. 110 of the second part of the monograph), where it is apparently a substitute name for *S. palustris* Heude, proposed in a footnote on p. 54 of the 1888 contribution for the South China pig that Swinhoe had earlier referred to *S. leucomystax*, the local race of Japan. But *Sus palustris* Heude is preoccupied by *S. palustris* Rütimeyer, a Pleistocene pig of Europe. Heude, in his five papers on pigs, uses the following names for those of South China: *chirodontus, palustris, acrocranius, leucorhinus, melas, phyllodontus, paludosus, pacificus, collinus, flavescens, chirodonticus*; and in the second of these contributions (Mém. concern. l'Hist. Nat. de l'Emp. Chin., 1892, II, p. 102) proposes that the Chinese pigs be included in a separate genus, *Sinisus*. Sowerby, in studying Heude's specimens at Shanghai, found two other manuscript names, *stricticeps* and *nigricans*, written on skulls from South China, and in his paper misquotes *melas* as *meles*, based on a skull from Kwangsi with a broad forehead and one less upper premolar than normal.

Wild pigs are common in Hainan, although not included in J. A. Allen's summary list of the mammals of that island. A large series of young was collected there by Mr. Clifford Pope in 1923, chiefly at Nodoa. All are very small and show the striped pattern. They were taken in late January and during February and March, which may thus represent the breeding period of the year. Two skulls of immature boars, in December, have the last molar still unerupted and seem indistinguishable from skulls of *S. s. chirodontus* at a like stage, so may be provisionally included with this race of southeastern China.

Cervidæ

Capreolus capreolus bedfordi Thomas

Capreolus bedfordi Thomas, 1908, Abstr. Proc. Zoöl. Soc. London, p. 32.

A series of over fifty roe deer from Mongolia (northeast of Urga), from Chihli (Lao Tsa Tsu), and from localities in Shansi, shows a large amount of purely individual variation in color. The type-locality of Thomas's *C. bedfordi* is one hundred miles northwest of Tai-yuen-fu in central Shansi, and the chief distinguishing character seems to lie in the lesser size as compared with *C. pygargus* of the Semiretshinsk Altai some 1800 miles to the westward. Still farther to the west there seems to be no doubt that intergradation takes place with the smaller races of Europe, for all the differences given for the Asiatic roes are of degree only. I am therefore relegating *bedfordi* to the status of a subspecies of *C. capreolus* instead of regarding it as a distinct species as Lydekker has done ('Cat. Ungulate Mamm. Brit. Mus.,' 1915, IV, p. 224) or making it a form of *C. pygargus* as Flerov has suggested (C. R. Acad. Sci. URSS, 1929, p. 429). I can find no constant differences that would serve to distinguish the Shansi roe from those of Chihli or northern Mongolia. The cranial measurements of all are closely similar, and the skins show the same variations where comparable material is available. In the bright reddish coat of summer there is a certain difference in tint, some being slightly paler with less extensive dark bases to the hairs, while the backs of the ears in specimens from the same locality in this pelage may be either a more or less even mixture of black and buff with black edges at the tips, or nearly the entire central area may be black. It seems to have been a variation of the latter sort that served as the type of *C. melanotis* Miller, from eastern Kansu, and which I have little doubt may be regarded as synonymous with *bedfordi*, for the cranial measurements are the same. A similar variation of color is seen in the spotted fawns, two of which from northeast of Urga agree in being much redder than a third that is decidedly more brown. In winter pelage the coat is a fairly uniform buffy gray, due to the subterminal pale-ochraceous rings and black tips of the individual hairs. On the sides and flanks the buff tint becomes clearer, and may be intensified to a rich ochraceous. The throat is usually more or less frosted with whitish, and in occasional specimens there are larger blotches of white. The absence of black marking on the upper lip and at the angle of the lower jaw is given as a distinguishing character of this race, but the present series shows that there is wide individual variation in this respect. The white spot at each side of the muzzle may be practically absent, or it may be small, or again more extensive, forming a white border to the fore part of the upper lip. The dark mark directly behind it may also be obsolete, while in other individuals from the same locality it may form a prominent spot, or mustache mark, or even extend across the muzzle as a dark brown band just back of the naked nose-pad. In a similar way, the dark mark at the angle of the lower jaw may be absent or more or less extensive. It is evident that no reliance can be placed on the absence of these markings as a distinguishing trait. The chin is usually white, but in some skins the whole interramal area is also white. The roe deer seems to be characteristic of forested areas in northern China, the single specimen from Wanhsien, in eastern Szechwan, marking probably about its southeastern limit.

Moschus moschiferus moschiferus Linnæus

Moschus moschiferus LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 66.

In a recent paper, Flerov (C. R. Acad. Sci. URSS, 1928, p. 515) has briefly reviewed the races of musk deer, and regards the typical form as that found in the "mountains of Western and Central Siberia." Linnæus merely states that it is found in "Tatari versus Chinam," a most indefinite locality, but perhaps to be interpreted somewhat as Flerov has done. The latter, however, considers the musk deer of eastern Siberia and northeastern Mongolia as a separate race, using for it Pallas's name, *sibiricus*. The chief differences noted are the smaller size, 151–158.8 mm. in length of skull, instead of 154.2-163.5 mm., as given for typical *moschiferus*, and the slightly grayer color—differences that seem, after all, unimportant in view of the considerable overlapping of the measurements. A fine pair of these little deer was secured by the Asiatic Expeditions 45 to 60 miles northeast of Urga, Mongolia, and is here referred to the typical race in spite of their small size (skull length 150 mm.). Both specimens, taken in late August, are changing from summer to winter coat, one of them having the new pelage short and dark grayish-brown, with a tuft of the stiff quill-like hairs of the caudal region still present, the other (August 24) with the new hairs just beginning to show in small patches on the withers and flanks, of a much darker shade than the old faded brown of the summer coat. Both are in the spotted phase, with about four lengthwise rows of indistinct pale or whitish spots on each side of the body. These are formed by the concentration of hairs having a whitish subterminal band, while on the flanks, neck, and limbs these white tips are scattered, giving a slightly grizzled effect. In a third specimen (? locality) the spots run together into prominent stripes on the sides and smaller indefinite markings on the shoulders and back. The interramal area is white in one, not in the other, and a white stripe passes down each side of the throat. The legs are mixed dark brown and gray, the front of the fore legs in the three skins at hand nearly clear dark brown.

The first musk deer to reach Europe was perhaps the one mentioned by Marco Polo, the Venetian traveller, who in the thirteenth century brought back with him the head and feet of a specimen he secured in his journey to "Tatary." He mentions it as abundant in the Altai and northern Chinese country, especially about Si-fan. Linnæus refers only to Ray, whose account is a transcription of that by Grew of a specimen then in the museum of the Royal Society of London. Pallas, in 1779, gave the first really good description and figures of the anatomy and external appearance, although a generalized figure showing the canines appeared much earlier, in the treatise on musk by Schroeck, in 1682.

Moschus moschiferus sifanicus Büchner

Moschus sifanicus Büchner, 1890, Mélanges Biol., XIII, p. 162.

The collections contain a single specimen without locality or skull that seems referable to this race.

The status of the musk deer of Kansu, Szechwan, and Nepal is still in need of more thorough investigation. Originally described from northern Kansu as a distinct species, *sifanicus* was believed to differ from the more northern *moschiferus* in having the ear longer, with the inside yellowish, and the outside black, instead of being white inside and grizzled like the head on the outside. Other differences were said to be the uniform instead of spotted coat and the longer rostral part of the skull; but occasional specimens of *M. moschiferus* may be unspotted (the variety *concolor* of Milne-Edwards) and the supposed greater length of the ears proves to be a mistake. The cranial differences, however, are well marked, particularly the longer rostrum, the larger cheek teeth, the shape of the lacrymal bone (longer than high), and the more forward extension of the median palatal notch. Lydekker, in 1915 ('Cat. Ungulate Mamm. Brit. Mus.,' 1915, IV, p. 7), regarded this Chinese musk deer as a subspecies of *moschiferus*, while more recently, Flerov (C. R. Acad. Sci. URSS, 1928), in a preliminary review of the group, recognizes *M. chrysogaster* Hodgson, of Nepal, as a distinct species with *sifanicus* as its northern race, and describes as new *M. berezovskii*, a smaller animal of Szechwan. Undoubtedly, the two first are very closely related, but in view of the occurrence of intermediate links it may be that Lydekker's view is nearer the truth, while it seems very doubtful if *berezovskii* can be more than a small individual of *sifanicus* with the description of which it otherwise agrees. A young male of *sifanicus* from Shuow-low, Szechwan, in the Museum of Comparative Zoölogy, has a cranial length of 154 mm., its coat is unspotted, yellowish below and on the ears, while the feet are gray instead of dark brown as usual in *moschiferus*. There is, however, considerable variation in color in these animals. No one has carefully compared Chinese specimens with those from Nepal and if it should prove that they are the same, Hodgson's name, *chrysogaster*, with fifty years priority, might replace *sifanicus*. The only available Nepalese skull is smaller than that from Szechwan, though a little younger, but otherwise agrees with it in the differential characters mentioned.

Hydropotes inermis inermis Swinhoe

Hydropotes inermis Swinhoe, 1870, Proc. Zool. Soc London, p. 89.

A small species with much superficial resemblance to the Chinese race of musk deer in its mixed yellowish and brown coat and the large canine tusks of the male. The head, however, is colored like the body and the feet are less dark, while in the skull the presence of a preorbital pit at once separates it.

This swamp deer is common in the river marshes of eastern China. The collection contains specimens from Chinkiang, Kiangsu Province (the type-locality), and from Tunglu, Chekiang, and Yochow, in Hunan.

Elaphodus cephalophus cephalophus Milne-Edwards

Elaphodus cephalophus Milne-Edwards, 1871, Nouv. Arch. Mus. d'Hist. Nat., Paris VII, p. 93.

Small deer of a nearly uniform dark chocolate-brown, becoming blackish on the limbs; throat, muzzle, and sides of face paler, finely grizzled; a gray line over the eye bounding a large frontal tuft of longer, brown hairs, which in the male nearly hide the short antlers on the ends of pedicels; white of inside of ear extending to the tip of the outer side; upper canine large in males, small in the females which are hornless.

This deer was first discovered in Moupin, Szechwan, by Père David. It is the largest of the races. A single adult female, taken at Lichiang, Yunnan, extends the known range considerably to the southwestward. Its skull measures 190 mm. in condylobasal length and is practically identical in size with that of a male figured by Milne-Edwards. The Lichiang skin is much darker than those representing the race *ichangensis* in which the general shade is less blackish, the basal portion of the body hairs slightly paler, while the ears are white only at the tips of the external side, instead of having a considerable part of the antero-external margin white.

Elaphodus cephalophus ichangensis Lydekker

Elaphodus ichangensis LYDEKKER, 1904, Proc. Zoöl. Soc. London, II, p. 169; Abstract, p. 10.

A slightly smaller race, typical in the country about Ichang. It is supposed to be an upland animal rather than a marsh-liver.

The Asiatic Expeditions secured three specimens near Wanhsien on the borders of Szechwan, above Ichang, that undoubtedly represent this race, while the Museum of Comparative Zoölogy has one female from Pudsee, Hupeh. Lydekker ('Cat. Ungulate Mamm. Brit. Mus.,' 1915, IV, p. 39) regards this as the most distinct of the four races he recognizes, but since he had only one specimen he could not determine the amount of individual variation, and admits that except in its slightly smaller size, smaller, deeper and more nearly oval antorbital pits, the skull is not especially characterized. It is, in fact, merely transitional to the coastal race. He supposes also that the amount of white in the tail is greater in this race and includes the terminal third, but this is not true of the four skins in the present series, for white markings are always likely to be variable in extent; yet the white on the outer rim of the ear is more extensive than in the single female of *cephalophus* from Lichiang.

Elaphodus cephalophus michianus (Swinhoe)

Lophotragus michianus SWINHOE, 1874, Proc. Zoöl. Soc. London, p. 452.

Smaller and more slender of skull than the other races, with narrow, pinched-in nasals. The type-locality is Ningpo, Chekiang Province, which must be close to the northern limit of the species' range. The Museum of Comparative Zoölogy has a pair of topotypical skulls that bear out the distinctness of this race. The most noticeable characters of the skull are its slenderness, and especially the narrow nasals which are peculiarly compressed or pinched together posteriorly instead of being flattened or spreading. The lacrymal pits are also slightly less in their vertical diameter. This, however, as well as the amount of white on the tips of the ears is variable and hardly forms a criterion for racial distinction. Lydekker further described a race of this deer as *fociensis* on the basis of a female from Fukien Province, which he says is "rather larger" with more white on the upper part of the ears. A skin from Yenping, Fukien, in the collections of the Asiatic Expeditions does not seem distinguishable nor do the measurements of the skull given by Lydekker differ from those of *michianus,* of which *fociensis* is doubtless to be regarded as a synonym.

Muntiacus muntjak vaginalis (Boddaert)

Cervus vaginalis BODDAERT, 1785, 'Elenchus Anim.,' I, p. 136. Ind a.

Wroughton, in 1915, compared a considerable series of Indian muntjacs, and concluded that those inhabiting Nepal, Upper Burma, and the Bengal region were all referable to *vaginalis*, a conclusion which Lydekker embodied also in his 'Catalogue of the Ungulates in the British Museum.' To this race apparently belong the five specimens from southwestern Yunnan secured by the Asiatic Expeditions, as well as a skin and skull in the Museum of Comparative Zoölogy from Tonkin. They are slightly smaller, with less robust antler pedicels and smaller antlers than the typical Javanese form. In color, the forehead is dusky, the crown bright ochraceous, the throat white. The neck, as far as the shoulders, is bright ochraceous slightly ticked with blackish. The back, including the upper surface of the tail, is bright chestnut, paling on the flanks and belly to ochraceous. The feet and legs are usually ochraceous, with sometimes a slight brownish wash near the lower extremities. The upper throat, insides of ears, axilla, groin, edge of buttocks, and lower side of tail are clear white. Evidently this larger muntjac with the chestnut tail is characteristic of the warmer latitudes, for it just reaches southern Yunnan (specimens from Teng-yueh, Taipingpu, Pehte, and Namting River) and Tonkin. It appears again on the island of Hainan, where it seems to be sufficiently differentiated to be worthy of subspecific distinction, as follows.

Muntiacus muntjak nigripes, new subspecies

Cervulus vaginalis SWINHOE, 1869, Proc. Zool. Soc. London, p. 652 (part).

Cervulus muntjak J. A ALLEN, 1906, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 468.

Muntiacus muntjak, subspecies, LYDEKKER, 1915, 'Cat. Ungulate Mamm. Brit. Mus.,' IV, p. 25.

TYPE.—Adult male, skin and skull, No. 60082, American Museum of Natural History, from Nodoa, island of Hainan, China; December 29, 1929; Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Slightly smaller than *M. m. vaginalis* as represented by specimens from Yunnan. Forehead in front of eyes, and the muzzle, dusky brown; sides of face and the crown clear bright ochraceous; a broad black mark on the front of each antler pedicel. Ears ochraceous at base becoming dusky at tips; their inner surface scantily clothed with white hairs. Chin and interramal area white to pale buffy. Dorsal area of neck dark chestnut-brown, shading to bright chestnut on the back and upper surface of tail, slightly paler (bright ochraceous) on sides of neck, throat, and flanks. The neck (especially) and the body are minutely ticked with black, through the black subterminal bands of many of the hairs. Fore shoulder and fore limb blackish brown becoming clear brown on the foot; hind leg similarly blackish near the hock, paling to brown on the front of the foot. Inner side of both legs ochraceous at the upper part. Axilla and groin white, the latter area continuing on the inner side of the leg to the heel, and dorsally to include the posterior edge of the buttocks and under side of the tail.

SKULL.—In all its dimensions the skull is slightly smaller than that of *vaginalis*. The antlers are small, their tips curving slightly inward and down. Their anterior basal point is very little developed, a bare projection, while their pedicels are apparently shorter. The tooth row is shorter and the size of the individual teeth is less.

MEASUREMENTS.—The skull of the type measures: condylobasal length, 181 mm.; basal length, 170; palatal length, 109; orbit to tip of muzzle, 102; zygomatic width, 86.5; mastoid width, 63; width outside molars, 61.5; upper cheek teeth, 61; lower cheek teeth, 67; length of antler pedicel, 89; length of antler, 56.

Swinhoe, in 1869, recorded this type of muntjac from Hainan, and Lydekker, in his 'Catalogue' of 1915, lists two skins obtained there by Swinhoe as representing an undetermined subspecies. The series secured by Mr. Pope indicates that in addition to the smaller size of this island race it is further distinguished by the darker legs which may be almost black or a paler brown. In the Indian race, represented by skins from Yunnan, the legs are usually clear ochraceous, though occasionally slightly tinged with pale brown.

The muntjacs of this group are easily distinguished from the smaller Chinese species by the larger skull and teeth, longer pedicels of the antlers, and by the relatively smaller suborbital glands which occupy only about the ventral two-thirds of the lacrymal bone. Further, the premaxillary abuts against the nasal at its upper extremity instead of being separated from it by a forwardly projecting strip of the maxillary.

Muntiacus reevesi (Ogilby)

Cervus reevesi OGILBY, 1838, Proc. Zoöl. Soc. London, p. 105.

Similar to *M. m. vaginalis* but about a third smaller, the coat slightly darker and more uniformly ticked, usually with a blackish nuchal line, which in females extends over the occiput and forehead to form a wide patch connecting the two black streaks marking the frontal ridges. Summer skins tend to be brighter, with clearer ochraceous flanks.

This muntjac seems to be confined to the southern half of China, for the most part, at lower elevations, for although recorded (under the name of *Cervulus lacrymans*) from Moupin by Milne-Edwards, it seems likely that his specimen came from somewhere in the upper Yangtze Valley rather than from higher altitudes of central Szechwan. The collections made by the Asiatic Expeditions contain over sixty skins and skulls of muntjacs from Fukien, Kiangsu, Hunan, Chekiang, and eastern Szechwan, which, together with a series in the Museum of Comparative Zoölogy from Hupeh Province, form an excellent basis for an estimate of the validity of the various nominal forms that have been described. Lydekker, in 1915, recognized three species as occurring in South China, with three additional subspecies. These were: (1) *M. lacrymans* of Milne-Edwards (type from Moupin, Szechwan) and two subspecies, *teesdalei* (from Tatung, Anhwei Province) and *sclateri* from Ningpo; (2) *M. reevesi* (type assumed to have come from Canton) and its subspecies *pingshiangicus* Hilzheimer from Anhwei Province; (3) *M. sinensis* Hilzheimer (type-locality also supposed to have been Anhwei) with which is included Lydekker's *Cervulus bridgemani*.

With the excellent series of over seventy specimens now before me, representing most parts of the animal's range, I can see no ground for recognizing more than a single form, *reevesi*, as A. B. Howell had already suspected. The original description is quite inadequate, for Ogilby merely mentions that it is less red than the Indian muntjac and lacks the white above the hoof. He had, as the basis of his brief account, a male, a female, and a spotted fawn, then (1838) living in the Zoölogical Gardens at London, whither they had been sent from China by J. R. Reeves, hence presumably from the Canton region. Milne-Edwards, in 1871, was the next to apply a name to this animal by distinguishing as *Cervulus lacrymans* a specimen sent by Père David from Szechwan, supposedly from Moupin, but perhaps from a less elevated district to the south. He remarks briefly that it differs from *reevesi* in the nearly parallel instead of divergent pedicels of the antlers. This, however, is purely an individual character, for in adult males from the same locality in the present series, some have divergent and others parallel or even incurving pedicels. In details of color, skins from eastern Szechwan (Wanhsien) can be matched by those from Fukien. Lydekker also uses the supposed greater divergence of the pedicels ("at least frequently") as a character of *M. sinensis* to distinguish it from *reevesi*, but since he had only two males, the distinction can hardly be regarded as valid in view of the variation shown among the twenty or more skulls from Fukien in the present series; the additional character of the narrowness of the nasals at their point of contact with the maxillæ proves also to be an individual matter. Swinhoe, in 1872, described *Cervulus sclateri* from Ningpo, Chekiang, but seems to have been led to do so chiefly because the fawns are spotted, while those of the Hainan muntjac he supposed to be unspotted. But we know now, that the Hainan muntjac is of another species, of which Mr. C. H. Pope brought back a number of spotted fawns. It is true, nevertheless, that these are darker, and the spots seem to be lost at an early age. In several specimens from Chekiang and Hupeh, I can see nothing to distinguish *sclateri*. The other described forms (*teesdalei*, *pingshiangicus*, *sinensis*, *bridgemani*) seem to rest chiefly on purely individual or sexual variations in color, all of which may be found in the excellent series from Fukien. For, while the usual color is a mixture of bright ochraceous minutely ticked with blackish on the dorsal parts of neck and body, this may be intensified to a dull chestnut or, through a lack of dark tips to the hairs, the flanks may be nearly clear ochraceous. Occasional specimens are much darker, owing to the extensive dusky bases of the hairs and the black tips, so that the entire sides of the body may be dull drab, the legs dark brown, and the cheeks darkened as well. The dark median line on the neck may be little developed, but usually extends at least half-way to the withers, and in females spreads out anteriorly to form a dark brown patch covering the forehead, while in adult males the forehead becomes brighter and clearer ochraceous-rufous with age, and the black is confined to the pedicel of the antler. A remarkable change with age is the increasing yellowness of the backs of the ears in males for, while in females and younger males the ears are dark blackish brown externally, with advancing age the clear ochraceous of the base in males encroaches more and more upon the exterior of the conch, until the entire back of the ear is of the same bright tint as the occiput and forehead. It is obvious that the various named races of Reeves's muntjac have been described without sufficient knowledge of the changes that take place in this sex. The antlers have a very small basal point, often hardly more than a projection, while the tips usually turn inward and downward. Swinhoe believed that the antler pedicels became shorter with age, but, although they undoubtedly increase in diameter and vertical thickness, the length seems to be an individual matter, varying in immature specimens of comparable age as well as in adults from the same locality showing corresponding conditions of tooth wear and cranial development.

This species differs notably from *M. muntjak* and its races in the much larger antorbital pit which occupies all but a narrow dorsal strip of the lacrymal bone and in the relatively shorter ascending branch of the premaxillary which does not reach the nasal but is separated from it by an intervening strip of the maxillary.

Muntiacus crinifrons (Sclater)

Cervulus crinifrons Sclater, 1885, Proc. Zoöl. Soc. London, p. 1, Pl. i.

A large muntjac, two feet high at the shoulder, of a general dark blackish-brown color, including the dorsal surface of the tail, but the head and neck very slightly mixed with ochraceous; forehead, sides of the face, backs of the ears, and the occiput including its well-developed tuft of longer hairs, ochraceous; interramal area, a small mark above each hoof, the edges of the buttocks, the lower side of the tail, and the inguinal area white, the last with a narrow ochraceous border. Antlers short, with a small projection on the inner side at the base.

This muntjac is at once distinguished by its large size and dark color, with the upper side of the tail blackish instead of reddish. Originally described from an animal sent to London by A. Michie, from Ningpo, Chekiang Province, eastern China, but one other specimen has been recorded, namely, one secured after much effort by Styan, the fate of which seems not to be known. Special interest therefore attaches to the capture of a third specimen, a male, brought back by the Asiatic Expeditions from Tunglu, Chekiang Province. It is adult with well-worn teeth, but the antlers, though very short, projecting only 65 mm. (2.55 inches) beyond the pedicel, are an inch longer than those of the type, hitherto the world's record. Probably this is a species close to the verge of extinction, of which a few remain in eastern China.

Rusa unicolor dejeani Pousargues

Rusa dejeani Pousargues, 1896, Bull. Mus. d'Hist. Nat., Paris, II, p. 12.

This sambar of Szechwan was provisionally named over thirty years ago, by Pousargues, who considered it very similar to the smaller race *swinhoei* of Formosa, but with a more bushy tail. No further comparisons have since been made to determine its distinctness from the large *R. unicolor* (type-locality, Ceylon) or *R. unicolor equinus* (type-locality, Sumatra) of India and Malaya, respectively. In the last (9th) edition of Rowland Ward's 'Records of Big Game,' 1928, antler measurements are given of the type in the Paris Museum, and of another in Lord Rothschild's possession, slightly larger, said to have come from "N. W. China." In the latter specimen, the length of antler on the outside curve is said to be 31 inches, or about the same as a large head of the Malay sambar (26–33 inches), while the greater bushiness of the tail, to judge from descriptions, seems unreliable as a distinctive character. For the present the race may be retained as Lydekker, in his 'Catalogue of Ungulates,' 1915, has done.

An adult female sambar was taken at Lichiang, Yunnan, by the Asiatic Expeditions, and is referred to this race. The entire pelage is stiff and coarse, the tail full and about 400 mm. long to the tips of the hairs. In color the forehead and backs of ears are grayish brown; a patch of darker clear brown behind the rhinarium extends as a narrow median line back to the level of the eyes; eyes surrounded by a broad ring of dull ochraceous; chin, except for a dark-brown spot in advance of the angle of the jaw, dull white, passing into pale drab on throat; neck drab-brown becoming darker and tinged with ochraceous posteriorly, especially on haunches; body generally dark brown becoming brighter or more rusty on the haunches with the admixture of ochraceous, tail rusty brown at the base, its terminal two-thirds nearly black. The feet are pale, nearly buff, with a faint trace of a dark median stripe down the front, while the metatarsal gland is surrounded by a pale rusty ring; axillary and inguinal regions, and edge of buttocks white. A second specimen, from Wa-tien, Yunnan, a male, is very much darker with a uniform rich dark-brown muzzle, cheeks, ears, and neck. The chin and upper throat are whitish. Posteriorly, the rusty tint is darker, extending on to the base of the tail. The feet are pale with an indication of a narrow median stripe as in the female.

Cervus canadensis xanthopygus Milne-Edwards

Cervus xanthopygus MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VIII, p. 376.

The nomenclature of the wapitis of eastern Asia is much in need of revision for which Lydekker's 'Catalogue of Ungulates' (1915) has only partly cleared the way. A. B. Howell has shown that the present animal is distinguishable by its reddish tone from the wapiti of northwestern China, to which Pocock gave the name *kansuensis*. The type of *C. xanthopygus* came from Manchuria, and the range is supposed to extend into the northern part of that country. I am provisionally referring to it the skin of a doe secured by Dr. R. C. Andrews, August 21, 1919, sixty miles northeast of Urga, Mongolia. It has practically shed its summer coat, of which scattered ochraceous hairs still remain on the fore shoulder and haunches, while the fresh drab-gray pelage of the new coat is still very short. The neck has a decided mixture of buff, and there is a dark-brown line from the occiput to withers. The chin is dark brown, pale at the sides in front of the dark mark near the corner of the mouth. In comparison with a series of both sexes representing *kansuensis*, it is decidedly more buffy on the neck, the rump disk is more extensive forward and of a deeper ochraceous, while the hoofs are considerably larger than in any of the Kansu animals, measuring 66 mm. along the median edge on the forefoot, and 67 mm. on the hind, against 53–60 and 60 mm., respectively, for the largest of the latter.

Lydekker, in his 'Catalogue' (1915, p. 134), proposed the name *Cervus canadensis baicalensis* as a substitute for his previous *C. c. asiaticus* quoted as from Severtzow (1873), but now rejected since the latter author apparently used the term *asiatica* in a group sense, not as a technical name, while the previous use of *Cervus sibiricus* by Schreber for a reindeer invalidated the employment of that term by Severtzow for this wapiti. The name *C. c. asiaticus* will thus have to date from Lydekker ('Deer of all Lands,' 1898, Pl. VI), with type-locality "the district to the southward of Lake Teletsk, near the sources of the Yenisei," whence the stag figured probably came. It is, however, a matter of uncertainty whether this is really a well-defined race.

The close relationship of the Asiatic wapiti to that of America is expressed by the trinomial, but the latter animal has a dark neck and contrastingly pale body, while the Asiatic representative is more uniformly drab-gray.

Cervus canadensis kansuensis Pocock

Cervus kansuensis Pocock, 1912, Proc. Zoöl. Soc. London, p. 573.

The collections of the Asiatic Expeditions contain five adult skins representing both sexes of this race of wapiti, probably all taken in Shansi. A series of six from the same Province is regarded by A. B. Howell as identical with six topotypes from near Taochow, Kansu, all in the U. S. National Museum, but he adds that he is not in a position to express an opinion as to the validity of the race. In its smaller hoofs and grayer tone, the lack of buffy on the neck, and the paler tint of the smaller rump patch, it seems to differ from *C. c. xanthopygus*. Wallace (1913) in his 'Big Game of Central and Western China,' figures (plate opposite p. 206) a stag of this animal shot in Kansu. The photographs bring out well the small size of the pale rump patch, which is restricted largely to the posterior part of the buttocks, but in the series studied, the dark color of the back may or may not extend as a line across it to the top of the tail. The antlers, as figured by Wallace, are of the usual wapiti type, as far as can be told; and, except for having one less point, do not seem essentially different from those described and figured by Lydekker (Proc. Zoöl. Soc. London, 1910, p. 987) as the type of *Cervus canadensis wardi*. These mounted antlers were from the Szechwan border of Tibet, and may have belonged to two individuals, although their slight asymmetry is duplicated by those shown in Wallace's photograph. Lydekker himself, in the 'Catalogue' (1915), states that "not improbably" they "may prove to belong to *C. macneilli*," another problematical species based on the skin of a female apparently paler than *C. kansuensis* and possibly of the *albirostris* type, although Lydekker regards it as representing a distinct species of which he makes *C. kansuensis* a more northern race. Certainly, however, the latter is a wapiti, and probably identical with *C. c. wardi*, a name which, if considered identifiable, might then replace *kansuensis*. At present, however, it does not seem possible to settle the status of these names, so that *kansuensis*, well defined by skins and antlered skulls, may be used until further information as to *wardi* and *macneilli* is available.

Alces alces bedfordiæ Lydekker

Alces bedfordiæ LYDEKKER, 1902, Proc. Zoöl. Soc. London, I, p. 109.

The elk or moose of the Old World ranges across the northern part of Eurasia from Norway to Amurland. Lydekker, in 1902, named the Siberian representative on the basis of the lack of palmation of the antlers, taking as his type specimen a pair of antlers from some locality in "Siberia," but exactly where is apparently uncertain. Lönnberg, shortly after, showed that the supposedly characteristic lack of palmation in the antlers occurs also among Swedish elk, while Elwes further suggested that this may be due to the lack of abundant nourishment in certain districts as well as to the elimination, through hunting, of the best-antlered males, leaving those with antlers less developed to breed. Zukowsky, in 1910, made a further contribution to the subject, regarding the elk of northeastern Siberia as a distinct form under the name *Alces pfizenmayeri* (antedating the name given it in 1911 by Millais, *A. machlis yakutskensis*). Zukowsky believed that the elk of Europe ranges across as far at least as the region to the south of Lake Baikal without change, but that the animals to the north of that area are much darker. He described as a new race the elk of the upper Yenisei, *A. machlis angusticephalus*, characterized by having a narrower skull with more prominent ridge between the antlers. It seems likely that the differences separating the eastern from the western animals are very slight indeed, and, until more critical comparisons can be made, the status of the name *bedfordiæ* must be regarded as still uncertain. For the present, however, it may be retained for the elk of central Siberia, meaning perhaps the Altai region, eastward.

The skin and skull of a single immature female were secured by the Asiatic Expeditions sixty miles northeast of Urga, Mongolia, and very likely this marks nearly the southern limit of the range in that country. The skin is a mixed gray and brownish on the cheeks, neck, and sides of the back, but the chest and flanks are clearer, darker brown, and the chin is blackish brown. The forehead and muzzle are tinged with ochraceous and the feet and legs are similar but slightly darker, becoming brown near the hoofs. A short mane stands erect along the median line of the neck and body and a very small (1 inch) "bell" or tuft is present at the throat. Altogether, the specimen appears paler than the moose of eastern North America, but no other Old World material is at present available for comparative study

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SOME CHINESE FRESH-WATER FISHES[1]

BY J. T. NICHOLS

XXIV.—TWO NEW MANDARIN FISHES

The mandarin fishes (*Siniperca*) are essentially omnipresent in China, abundant, and variable. On the basis of material examined to 1928 the writer recognized the three classic forms, *chuatsi* and *chuantsi* of Basilewski and *scherzeri* of Steindachner,[2] finding *chuatsi* and *scherzeri* readily identifiable and quite unlike. The form which was identified with *chuantsi* (specimens from Anhwei) is superficially much like *scherzeri*, though perhaps as closely related to *chuatsi*. Since then, critical examinations of further material discloses a fourth elongate aberrant form in Fukien, a fifth which is quite distinct, remarkably constant in a series of specimens to hand, and which apparently does not reach a large size, in Kiangsi.

It is somewhat doubtful if *Coreoperca whiteheadi* from Hainan Island is indeed generically separable from *Siniperca*, but as it seems less closely related to any mainland form than these are to each other, that matter may rest in abeyance. The small scales of *Siniperca* are irregular and very difficult to count accurately, which vitiates somewhat this otherwise very useful specific criterion in the genus.

Siniperca elongata, new species

DESCRIPTION OF TYPE.—No. 9674, American Museum of Natural History, from Kienyang, northwestern Fukien, April, 1926, collected by Clifford H. Pope.

Length to base of caudal, 156 mm. Depth in this length, 4.8; head, 2.9. Eye in head, 5.5; snout, 3; interorbital, 7; maxillary, 2; width of body, 2.5; length of peduncle, 2.8; its depth, 4; pectoral, 2.1; ventral, 1.8; longest dorsal spine, 2.5; dorsal ray, 3; longest anal spine, 2.7; anal ray, 2.7; caudal, 1.8.

Dorsal XIII, 10½; anal, III, 7. Scales, about 130.

Little compressed, back not at all elevated; eye distinctly superolateral; snout pointed, lower jaw strongly projecting; mouth little oblique, maxillary to under posterior border of pupil or beyond; gill-membranes joining under middle of opercle, free from isthmus; gill rakers rudimentary. Teeth of moderate size, sharp, conical, irregular, in more than one row on jaws; fine teeth on vomer and palate, none on the tongue; an outer row of small crowded teeth at the sides of the lower jaw. Opercle ending in a sharp spine, with a smaller spine above it; two groups of slight serrations along its lower limb; scapular serrate; ascending limb of preopercle with sharp spines which are largest at the angle; and two forwardly directed spines on its lower limb. Pectoral symmetrical; ventral origin well behind pectoral axil; caudal slightly rounded. Scales small, cycloid; no evident scales on opercle or preopercle; lateral line complete.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 102.

[2] 'A Provisional Check-list, etc.,' Bull. Amer. Mus. Nat. Hist., LVIII, p. 51, Figs. 44, 45.

Back and sides irregularly spotted; a few spots on the caudal, forming cross-bands posteriorly.

A single cotype is more boldly spotted on body and fins, much as in *Siniperca chuatsi*, and has the following measurements: standard length, 147 mm.; depth, 4 5; head, 2.9; eye, 4.6; dorsal, XIII, 10½; anal, III, 7; scales, about 120.

Siniperca obscura, new species

Description of Type.—No. 9675, American Museum of Natural History, from Hokou, northeastern Kiangsi, June 22 to July 12, 1926, collected under the direction of Clifford H. Pope.

Length to base of caudal, 81 mm. Depth in this length, 2.7; head, 2.9. Eye in head, 5; snout, 3.2; interorbital, 6.5; maxillary, 2.5; width of body, 1.5; length of peduncle, 3.6; its depth, 3.3; pectoral, 1.9; ventral, 1.8; longest dorsal spine, 2.1; dorsal ray, 2.8; longest anal spine, 2.1, anal ray, 2.4; caudal, 1.9.

Dorsal, XIII, 10; anal, III, 8. Scales, 75.

Moderately compressed, back little elevated, eye slightly superolateral; lower jaw slightly projecting; mouth moderately oblique, maxillary not extending quite to under middle of eye; gill-membranes joining narrowly free from isthmus under hind part of preopercle; 6 developed gill-rakers. Teeth of moderate size, subequal, sharp, conical, in several rows on the jaws; fine teeth on vomer and palate, none on the tongue. Opercle ending in a sharp spine, with a smaller spine above it; a scapular spine; ascending limb of preopercle with several small spines, 3 on its lower limb, the two anterior turned forward, a larger spine at the angle. Pectoral symmetrical, rounded; ventral origin behind pectoral axil; caudal slightly rounded; middle anal spine enlarged, so that it laps well past the tip of the third when depressed. Scales small, cycloid, no evident scales on opercle or preopercle; lateral line complete.

Color dusky, pale on the belly; sides with obscure dark blotches; fins essentially unmarked.

Fifteen additional specimens with the same data measure as follows:

Standard Length	Depth in Length	Head	Eye in Head	Dorsal	Anal	Scales
49 mm.	2.9	2.9	3.8	XIII, 10½	III, 8	est. 85
55	2 9	2 9	4	XII, 10	III, 8	est. 85
57	2.7	2.9	4	XII, 10	III, 8	85
59	2.6	2 9	4.3	XIII, 10	III, 8	85
60	2.9	2 9	4	XIII, 10	III, 8	80
60	2 9	2.8	4 3	XIII, 10	III, 8	80
61	2.7	2.8	4.2	XIII, 10	III, 7	80
63	2.8	2 8	4	XIII, 10	III, 8	80
64	2.8	2 8	4 5	XIII, 10	III, 8	80
65	2.7	2 9	4.5	XIII, 10	III, 7½	est. 75
66	2 8	2 9	4.5	XIII, 10	III, 8	75
67	2.8	2 9	4 7	XIII, 10½	III, 8	73
68	2.9	2.9	4.5	XIII, 10	III, 8	73
72	2.9	2.9	4.5	XIII, 10	III, 7½	75
72	2.6	2.9	4 5	XIII, 10	III, 8	80

In addition to the above, a single specimen from Yungtai Hsien, Fukien, is referable to this species. It measures as follows: standard length, 55 mm.; depth, 2.6; head, 2.6; eye, 4; dorsal, XIII, 10; anal, III, 8; scales, 90 or 100.

Siniperca chuantsi (Basilewski)

Boulenger (1895, 'Cat.,' 2d Ed., I, p. 136) synonymizes *S. chuantsi* with *chuatsi*, but in our opinion it may be referred with reasonable certainty to a recognizable form, a specimen of which from Hokou, Kiangsi, is described below.

Length to base of caudal, 144 mm. Depth in this length, 3.6; head, 2.7. Eye in head, 5.7; snout, 3.2; interorbital, 5.7; maxillary, 2; width of body 2.1; length of peduncle, 2.9; its depth, 3.8; pectoral 2.4; ventral, 2.2; longest dorsal spine, 4.4; dorsal ray, 3.7; longest anal spine, 3.7; anal ray, 3; caudal, 2.

Dorsal, XII, 13; anal, III, 9. Scales about 140.

Little compressed, back not elevated, eye slightly superolateral; lower jaw decidedly projecting; mouth little oblique, maxillary extending to under posterior margin of pupil or beyond; gill-membranes joining narrowly free from isthmus under middle or front part of preopercle; 4 developed gill-rakers. Teeth unequal, sharp, conical; in several rows on the upper jaw, where the midline is toothless and 2 or 3 teeth adjacent to it somewhat enlarged; in several rows on the front of the lower jaw, with wide-spaced enlarged teeth on the sides of same; fine teeth on vomer and palate, none on the tongue. Opercle ending in a spine, with a shorter, broad, blunt spine above it; a blunt scapular spine; ascending limb of preopercle serrate, its lower limb with 2 or 3 more or less antrorse spines. Pectoral symmetrical, rounded; ventral origin behind pectoral axil; caudal rounded; tip of middle anal spine about reaching that of the last spine when depressed. Scales small, cycloid; opercle and preopercle scaled; lateral line complete.

Sides well covered with dark spots and blotches, the larger tending to form rings; dorsal and caudal spotted, and anal with a few spots.

Two other specimens with the same data, have the following measurements:

Standard Length	Depth in Length	Head	Eye in Head	Dorsal	Anal	Scales
66 mm.	3.5	2.6	5	XII, 13	III, 9½	est. 120
204	3.2	2.9	6.1	XII, 13	III, 9	120

The five species of *Siniperca* recognized here may be identified by the following key.

1.—Depth (in standard length), 4.5 or more (at about 150 mm.); gill-rakers rudimentary; dorsal rays XIII, 10 or 11; scales, about 130. . . . . *elongata.*

Depth, 3.5 or less (at lengths up to 190 mm.); gill-rakers, 4 to 6; dorsal rays XI to XIII, 10 to 15; scales, 100 to 180. . . . . .2.

Depth, 2.6 to 2.9 (at 50 to 80 mm.); gill-rakers about 7; dorsal rays XIII (rarely XII), 10 (rarely 11); scales, 73 to 85; middle anal spine elongate and lapping well past the third when depressed. . . . . *obscura.*

2.—Dorsal XIII, 10 to 13; scales, 100 to 150; eye smaller (5 or 6 in head) and back not elevated; depth, 2.8 to 3.5 (at 50 to 150 mm.); more finely mottled, spots forming rings on sides. . . . . *scherzeri.*

Dorsal XII, 12 or 13; scales, 120 to 140; otherwise like the preceding. . *chuantsi.*

Dorsal XII (rarely XI or XIII), 13 to 15; scales, 145 to 180; eye larger, 4 to 5.5 in head (at 80 to 190 mm.); back more or less elevated, depth 2.7 at 80 mm. to 3.3 at 194 mm.; spots on sides rarely forming rings. . . . . *chuatsi.*

Specimens of *Siniperca chuatsi* have now been examined from Tungting Lake; Ningkwo, Anhwei; Kienning and near Yenping, Fukien; of *S. chuantsi* from Ningkwo, Anhwei; Hokou, Kiangsi; of *S. scherzeri* from Tungting Lake; Hokou, Kiangsi (inseparable but not typical); and Kienyang, Fukien.

Small *Siniperca*, at standard lengths less than 50 or 55 mm., tend to have the lower jaw very prognathous, anterior profile of head and back slanting, and specific characters more or less obscured. Thus, a specimen of *S. scherzeri* of 47 mm. from Hokou has depth 2.8, back elevated, eye 4 in head, but is obviously this species, fitting in a series of same of 50, 64, 69, 111 mm. and larger, and with dorsal XIII, 12. Another small specimen of 54 mm. with the general locality Fukien is puzzling (depth 3.4, back only slightly elevated, eye 4, dorsal XII, 14). Fin count seems almost the only character to place it with *S. chuatsi*, but from comparison with a fish of that species of 56 mm. from Ningkwo (depth 2.8, back elevated) it seems probable that it is such. On the other hand, *S. obscura* down to 49 mm. are very like those of larger size.

XXV.—*NEW SARCOCHEILICHTHYS* IN NORTHEASTERN KIANGSI

We have from Hokou, northeastern Kiangsi, four specimens of this usually abundant genus, collected under the direction of Clifford H. Pope, June 22 to July 12, 1926, which are quite unlike what was to be expected. Elsewhere in China, one or another race of the subgenus *Chilogobio* has been found to occur, frequently with *S.* (*Barbodon*) *sinensis*, than which they are somewhat smaller fishes. Here, however, is a minnowlike dwarf form of the subgenus *Barbodon*, apparently adult on account of horny processes on the head; and with it two larger specimens, unusually large for *Chilogobio*, differing from the various races of *S.* (*Chilogobio*) *nigripinnis* about as these differ from one another, but with characters of the typical subgenus *Sarcocheilichthys*, represented by *S. variegatus* of Japan (with which they have been compared).

Sarcocheilichthys (Barbodon) parvus, new species

Description of Type.—No. 9676, American Museum of Natural History, from Hokou, northeastern Kiangsi.

Length to base of caudal, 57 mm. Depth in this length, 3.8; head, 4.8. Eye in head, 3.6; snout, 2.7; interorbital, 2.6; maxillary, 2.6; width of mouth, 4.5; length of mouth, 4.5; width of body, 1.6; depth of peduncle, 1.6; its length, 1.1; pectoral, 1; ventral, 1.2; longest dorsal ray, 1; longest anal ray, 1.2; cuadal lobe, 0.9.

Dorsal, 9; anal, 8. Scales, 36.

Not much compressed, vent at three-sevenths the distance from ventral axil to anal origin. Top of head slightly convex; side of snout with two groups of well-developed horny warts; lower jaw with a horny tip; a very minute barbel present; gill membranes broadly joined to side of breast behind middle of opercle. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and proximal third of last anal ray when depressed; ventral origin a little behind that of dorsal; its base before center of dorsal base; dorsal margin slightly convex, anal even; pectoral extending three-fourths the distance to ventral, ventral two-thirds to anal; caudal moderately forked. Scales with slightly radiating striæ; lateral line complete, straight, in the middle of side, rising a little at front end to meet opercle.

Dark on the back, and in a band from snout to caudal, which is broadest (about as broad as eye) posteriorly. Dorsal and caudal grayish, dorsal with a faint dusky cross-streak; pectoral pale; ventral and anal more or less dusky.

The cotype has length, 40 mm.; depth, 4; head, 4.6; eye, 3.1; dorsal, 9½; anal, 8½; scales, 36; warts present, less developed.

As the striking color of this form may be due to small size, its low scale count is perhaps its best differentiating character.

Sarcocheilichthys kiangsiensis, new species

DESCRIPTION OF TYPE.—No. 9677, American Museum of Natural History, from Hokou, northeastern Kiangsi.

Length to base of caudal, 129 mm. Depth in this length, 4.6; head, 4.7. Eye in head, 4.5; snout, 2.4; interorbital, 2.9; maxillary, 3.4; width of mouth, 4; its length, 6; width of body, 1.7; depth of peduncle, 1.9; its length, 0.9; pectoral, 1.3; ventral, 1.4; longest dorsal ray, 1.5; longest anal ray, 1.8; caudal lobe, 0.9 (est.–broken).

Dorsal, 9½; anal, 8. Scales, 43.

Moderately compressed, vent about midway between ventral axil and anal origin. Top of head slightly convex; mouth small, somewhat inferior, horizontal, curved; lips thickish, leaving the mandible free, which has a narrow columnar base and expanded end, the end somewhat callous or slightly horny; a distinct thickish rudiment of a barbel at either side of mouth, with tip barely free; gill-membranes broadly joined to breast under middle of opercle. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and end of last anal ray when depressed; anal base under or slightly before middle of dorsal base; dorsal and anal margins slightly concave; pectoral and ventral rounded; pectoral extending two-thirds the distance to ventral, ventral three-fifths to anal; caudal forked. Scales with close-set slightly radiating striæ; lateral line complete, in the middle of side, rising a little to meet opercle.

Somewhat darker above, with irregular, scattered, narrow, dusky bars and spots,—and pale below; a vertical black bar behind the gill opening. Dorsal grayish; caudal lobes slightly dusky; lower fins pale.

The cotype has length, 141 mm.; depth, 4; head, 4.7; eye, 4.8; dorsal, 9; anal, 8½, scales, 43.

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TWO NEW SPECIES OF *DINOGAMASUS*, MITES FOUND ON CARPENTER BEES OF THE ORIENTAL TROPICS

By Norma LeVeque[1]

Two new species of mites, *Dinogamasus philippinensis* and *Dinogamasus piperi,* bear a strong resemblance to *Dinogamasus* (*Greenia* Oudemans, *Dolaea* Vitzthum) *perkinsi* (Oudemans), and may be designated as belonging to the *perkinsi* group. It is interesting to note that the new species were found on members of the same group of carpenter bees to which the host of *D. perkinsi* belongs. These carpenter bees, which are confined to the oriental tropics, differ from other mesotrichian bees especially in regard to the peculiar legs of the males; whereby Westwood originally established the subgenus *Platynopoda.* Ashmead has suggested that *Platynopoda* should be considered to be of generic rank, which doubtless should be done.

Dinogamasus perkinsi (Oudemans) was originally recorded from *Mesotrichia* (*Xylocopa, Koptorthosoma*) *tenuiscapa* (Westwood), from Java and India. It has been recorded by Vitzthum (1919) from *M. latipes* (Fabricius) and *M. tenuiscapa,* from East Indies, Cochin China, and Java; (specimens from Naturhistorischen Museum of Hamburg). Vitzthum (1930) also records *D. perkinsi* from *M. tenuiscapa* from Ceylon, from *M. latipes* from Ceylon, Sumatra, and Java, and also from *M. auripennis* (Lepeletier) from Sumatra.

I have found *D. perkinsi* only in the abdominal pouch of *M. latipes,* which specimens were from Trang, Siam, and from Buitenzorg and Soekaboemi, Java, and also in a subspecies of *latipes* from Depok and Buitenzorg, Java. The mite which I found in *M. tenuiscapa* (determined by Dr. T. D. A. Cockerell) is the new species, *D. piperi,* collected by C. V. Piper in India, 1911. *M. tenuiscapa* originally came from India. My determination of *D. perkinsi* was made upon comparison with a named specimen kindly sent me by Dr. Vitzthum, taken from *M. latipes,* from Java. Since there has been some confusion about the description of *perkinsi,* I am including camera lucida drawings of various structures for comparison with the two new species herein described. See Fig. 1.

Members of the *perkinsi* group have the following features in common:

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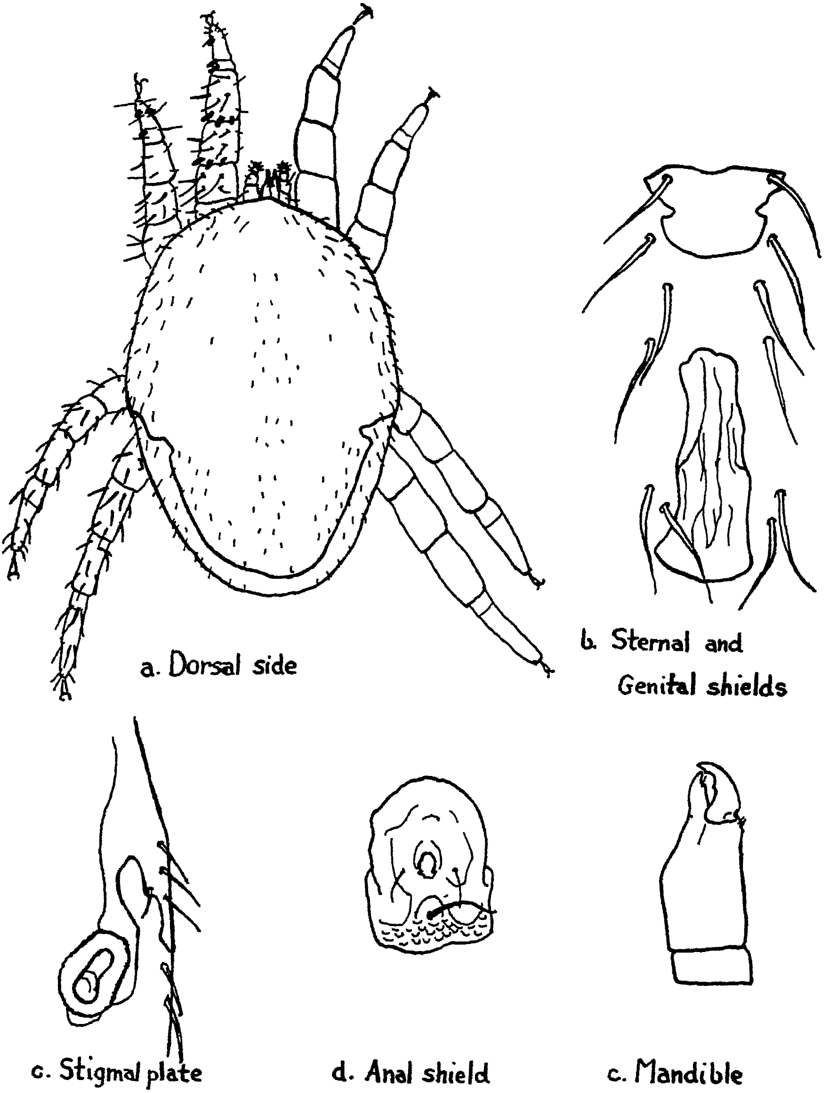
[1] University of Colorado.



a. Dorsal side

b. Sternal and Genital shields

c. Stigmal plate

d. Anal shield

c. Mandible

Fig. 1. *Dinogamasus perkinsi* (Oudemans), female.

Length: from 2 mm. to 3 mm. Dorsal shield has distinct, irregular, lateral notch just posterior to legs IV. Sternal shield is escutcheoned, often notched laterally. Anal shield has breadth to length, usually of 3 to 4; the posterior margin is usually as broad as the width of the shield through the anus; the lateral sides are almost parallel; the anal opening is placed very close to the center of shield, or nearer to the margin. Peritrematalia are rudimentary, or discontinuous, or prominent and fused with a projection of the dorsal shield. Fixed digit of mandibles has prominent tooth on cutting edge; length of fixed digit is about three-fourths that of the movable digit. Hairs ventral on legs I are unmodified and weak. Blunt cones on legs I vary on the different segments of the species of this group, hence they will be described for each species. The only blunt cones on legs II are on the tarsus: one outward near apex, one ventral near apex, the third distal and outward on the basitarsus.

KEY TO SEPARATE *Dinogamasus perkinsi*, *philippinensis*, AND *piperi*

1.—Body at least 2.4 mm. long; dorsal shield and posterior margin of body sparingly covered with fine short hairs; peritrematalium continuous with dorsal shield; second pair of sternal hairs placed lateral to sternal shield but not on the shield; all coxal spines similar.............................2.
Body not over 2.4 mm. long; dorsal shield and entire margin of body covered with moderately long hairs; peritrematalium not continuous with dorsal shield; second pair of sternal hairs placed on sternal shield near the posterior corners; coxal spines not uniform in size and shape..................*philippinensis.*
2.—Dorsal shield not entirely covering posterior lateral margins of body; patella I and tibia I with three blunt cones basal...................*perkinsi.*
Dorsal shield practically covering body except at notch; patella I with six blunt cones; tibia I with three basal cones and one midway-outer cone....*piperi.*

Dinogamasus philippinensis, new species

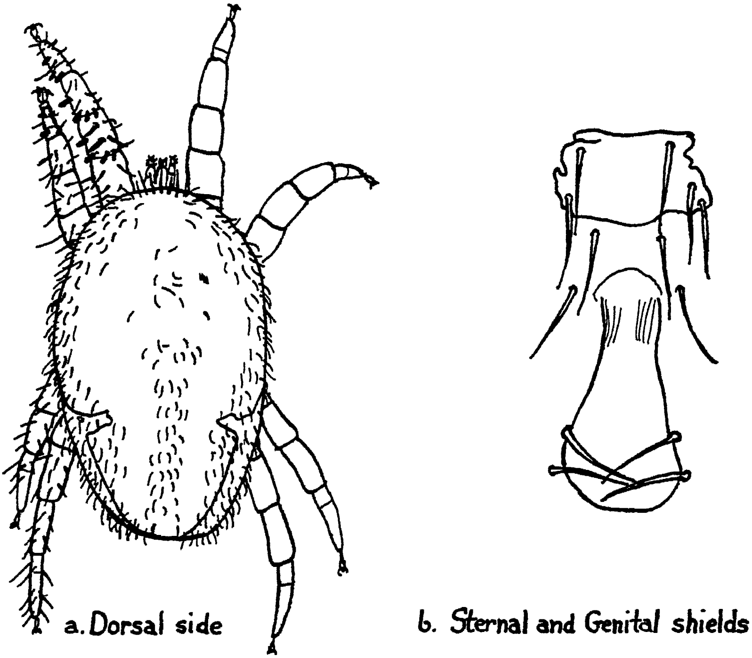
FEMALE.—Smaller than *D. perkinsi*. Length: 2000μ–2300μ. Width: 1260μ–1400μ. Legs: I, 1460μ–1540μ; II, 1300μ–1420μ; III, 1500μ–1720μ; IV, 1780μ–1900μ.

Notch in dorsal shield, just posterior to coxæ IV, is more pronounced than that of *D. perkinsi*. Four or five rows of moderately long soft hairs surround the body extending irregularly on to the dorsal shield, except at the extreme anterior and posterior ends. Similar hairs extend through the median region, grouped in pairs or in small clusters of six or ten, followed by a more regular grouping of the hairs, three or four abreast, in the posterior third of the median area. (Similar hairs on *perkinsi* are very short.) An irregular projection of the dorsal shield extends on to the ventral side close to legs II. See Fig. 2.

Sternal shield: scaled; rectangular; wider than long (340μ×220μ); margin irregular, especially the lateral margins. Second pair of sternal hairs are on the shield (those of *perkinsi* are on the soft skin).

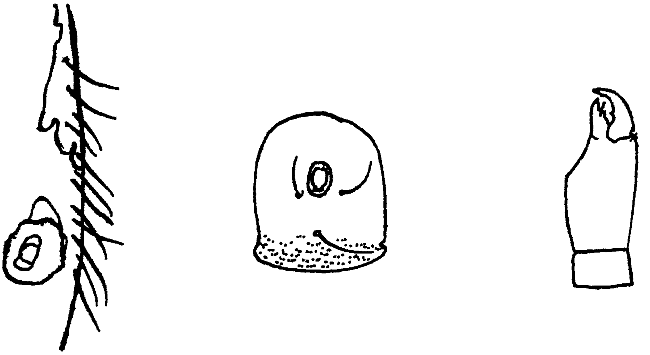
Genital shield: 600μ long, 300μ wide at posterior end, and 100μ at anterior end. (The genital shield of *perkinsi* is also 600μ long but is narrow, the sides almost parallel, measuring 200μ at the posterior end and 160μ at the anterior.)

Anal shield is very similar to that of *perkinsi;* it measures 400μ in length, 300μ in width. There is a decided broadening of the posterior margin of the shield.



a. Dorsal side

b. Sternal and Genital shields



c. Stigmal plate

d. Anal shield

e. Mandible

Fig. 2. *Dinogamasus philippinensis*, female.

The stigmal plate is 180μ×140μ. The peritrematalium in the form of a triangle extends only 60μ anteriorly. See Fig. 2c.

Coxal spines on legs I and II are enlarged and taper to a fine point, the anterior spine on leg II is less stout than the others; the spines on coxa III are slender and sharply pointed, the anterior one being very small. The structure on coxa IV is not unlike the other unmodified hairs on that leg.

The three basal cones on the dorsal side of patella I are stronger than those on the same segment of *perkinsi;* there is also a cone midway on the outer side which is represented on *perkinsi* by a sharp spine. The four central dorsal hairs are heavy, with occasional blunt tip; they suggest a transition stage to the formation of blunt cones.

The inner of the three basal cones on tibia I is quite weak; the structure on the outer surface of the same segment is usually a blunt cone, sometimes it is a blunt spine.

There are too blunt basal cones on tarsus I, and on the outer side there is a short, curved, blunt cone midway between the basal cone and the apex.

Legs II are very similar to those of *perkinsi,* tarsus II having one blunt cone outward on basitarsus, and two somewhat shorter blunt cones ventral near the apex of the segment.

HABITAT.—Abdominal pouch of *M. latipes* from Cuernos Mountains, Negros, Philippine Islands; C. F. Baker, collector. (Specimen of bee in Dr. Cockerell's collection.)

HOLOTYPE.—At The American Museum of Natural History, New York City.

Dinogamasus piperi, new species

FEMALE.—Length: 2500μ–2600μ. Width: 1600μ–1700μ. Legs: I, 1700μ; II, 1660μ; III, 1800μ; IV, 2200μ.

This species which is very similar to *D. perkinsi* can be distinguished from it readily upon examination of the cones on legs I. Patella I has six well-chitinized short blunt cones, three of which are basal, one midway-outer, the other two are spaced somewhat evenly on the median dorsal region of the segment. Tibia I has the usual three basal cones and also a midway-outer cone. Tarsus I has the usual three cones: two on the basitarsus, and an outwardly directed one nearer to the apex. A dorsal-apical region, thinly chitinized, on the tarsus, bears many fine soft hairs. Coxal spines, swollen at the base, taper abruptly to a sharp needle-like point; all are very much alike except that the anterior spine is usually smaller than the posterior one on each coxa. See Fig. 3.

There is not the more or less extensive margin of soft skin around the posterior part of the dorsal shield. The shield covers almost the entire back; thus the lateral irregular notch in the region above legs IV may be difficult to detect. On the back are scattered a very few short hairs. The very few hairs on the ventral posterior region are likewise very short. Slightly longer hairs are found anteriorly on the margin of the body.

Sternal shield, scaled, bears the first pair of sternal hairs near the acute anterior corners. The second pair flanks the rounding posterior third of the shield. All four pairs of sternal hairs and the genital hairs are robust and taper to a very long fine point. The shield measures 360μ along the anterior margin; it is 260μ wide between the second pair of hairs; the length is 280μ. See Fig. 3*b*.

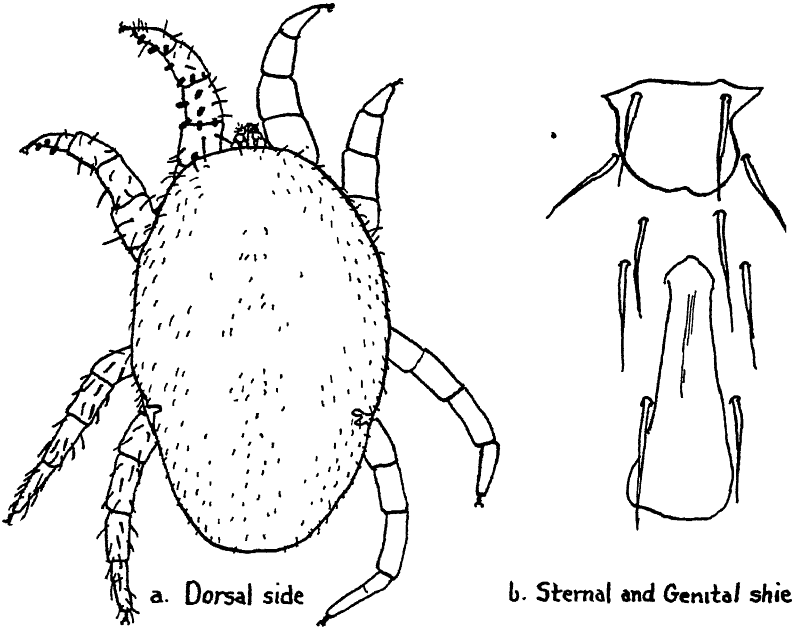
Genital shield: 280μ at greatest width near rounding posterior margin; 620μ long.

Anal shield: 340μ at greatest width, which is through anus; 260μ wide at posterior margin; 440μ long. Anus above center of shield. Unpaired hair is slightly nearer to the posterior margin than to the anus.

Peritrematalium is narrow and extends forward meeting the over-cupping dorsal shield.

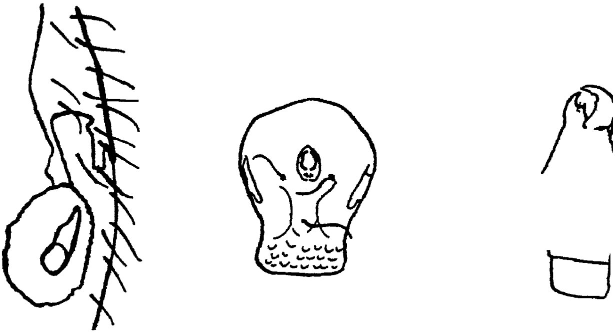
HABITAT.—Abdominal pouch of *M. tenuiscapa* (Westwood), from India; C. V. Piper, collector; (National Museum specimen).

HOLOTYPE.—At The American Museum of Natural History, New York City.



a. Dorsal side

b. Sternal and Genital shields



c. Stigmal plate

d. Anal shield

c. Mandible

Fig. 3. *Dinogamasus piperi*, female.

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59 57, 99 (78)

ROCKY MOUNTAIN BEES. I

By T. D. A. Cockerell and Beular Hix Blair

1.—INTRODUCTION

By T. D. A. Cockerell

The undetermined Rocky Mountain bees belonging to The American Museum of Natural History have been loaned to the University of Colorado and will be discussed in a series of papers under the above general title. This very large collection was nearly all obtained by the expeditions conducted by Dr. F. E. Lutz a number of years ago, and is from numerous localities in Colorado, as well as some in Wyoming and other states. Some portions of it have already been recorded and described (e.g., in Novitates Nos. 23, 24, 40, 47, 226, 252). It is not very probable that the whole collection can be adequately dealt with in the near future. The enormous series of *Halictus*, for example, really requires the whole time of a competent student for many months. Doubtlessly, certain species are represented by hundreds of specimens, but each specimen has to be very critically examined, by one familiar with the group, in order to be determined. Nevertheless, it is expected that progress can be made, and many interesting facts brought to light. Every effort will be made to determine facts of general biological interest, or of significance in relation to broad problems of taxonomy and geographical distribution. For this reason it will be undesirable to restrict the discussions entirely to Rocky Mountain bees, since the interesting features of these can best be understood by comparison with those of their relatives in other regions. Certain types of investigation are especially desirable, in the present state of our knowledge.

(1). Biological observations, concerning nesting habits, natural enemies, parasites, mating of sexes, flowers visited, time of flight, altitudinal distribution, etc. Most of this must be done in the field but, as Mr. Chas H. Hicks demonstrated, it is possible to bring the nests, and particularly hollow stems of herbaceous plants, into the laboratory, and have insects hatching during the winter months. This type of work presents almost endless opportunities, but it should be critically and analytically discussed. Both in biology and morphology, it is easily possible to be too verbose, and cover pages with details which, at least as presented, have no clear significance. In every case we must ask (*a*) What is it? (*b*) Why is it? (*c*) What are the consequences?

(2). Morphological observations, concerning the structure of the mouth-parts, the venation, the genitalia, the abdominal sternites, the legs, etc. By such means we may reach adequate definitions of the families, tribes, genera, subgenera, species, subspecies and races. It cannot be taken as an axiom that forms with identical genitalia must be conspecific, but the presumption is that they are at least very closely allied. The genital structures are so complex that they are not likely to be repeated in different lines of descent. In the case of the mouth-parts, there are certainly parallel developments, as in the lengthening of the parts and the reduction in numbers of palpal joints, in quite different families. The advancement or specialization of the parts is not uniform, and a species with highly differentiated mouth-parts may have primitive features in the venation, or the venation may be relatively specialized while the tongue and palpi remain little modified from the supposed ancestral type. These facts, as in the Mammalia, greatly aid in the construction of a system which represents the actual phylogeny of the insects. In the vertebrate series, the teeth on the one hand, and the paired appendages on the other, show independent modifications, and using these together we may go far toward the establishment of a genuinely valid system of classification.

(3). Taxonomic investigations, based on the above. In the accurate definition and limitation of genera and higher groups, it is not at all desirable to consider only a single fauna. This method of work has impaired the validity of many of the conclusions reached by Robertson in Illinois, in spite of the fact that his skill and diligence have been truly remarkable. The question, how many genera should we recognize, remains in a manner insoluble, or necessarily dependent largely on conventions, which differ at different times and in different groups. It is a generally acceptable postulate, that the members of a genus must have had a common ancestor possessing the generic characters. That is, the genus must not be polyphyletic. As a consequence of this, if we consider the loss of an intercubital nervure in the *Andrena* group a generic character, several groups allied to *Andrena* but with only two cubital cells must be treated as distinct genera. They are manifestly derived, by parallel modification, from different groups of *Andrena*. At the same time, except for the venational character, in which they agree, they belong to *Andrena*. It is probable that such groups as these would be better treated as subgenera, in spite of the desire to dismember, if possible, such a large genus as *Andrena*.

Among the larger genera, we greatly need exact studies which will enable us to define natural groups or subgenera. In the absence of such groupings, authors describe numerous species without any reference to the structural peculiarities which indicate their group-positions. Thus, the arrangement of the species tends to become chaotic and unnatural, much as it used to be in the snail genus called *Helix*, until

Pilsbry took it in hand. Unquestionably, we shall have to define and name many more subgenera, but I have been inclined to proceed slowly with this work, in the absence of sufficient morphological studies to place it on a firm foundation.

The problem of subspecies or races among bees is becoming very interesting. Its proper elucidation requires good series from many diverse localities. By the term subspecies I understand a group of individuals inhabiting a particular region, having in common, or at least normally, certain peculiarities by which they may be distinguished, yet without marked structural characters. When a species has split into two or more subspecies, we conventionally retain the original specific name for the race first described and designate the others by special subspecific names. For the purposes of nomenclature, we are not required to state which is actually the oldest form. This is really unavoidable, yet it may be misleading. Thus, in the Palæarctic fauna, most of the wide-ranging species were first described from Europe. Subspecies inhabit Siberia, Japan and other countries. We naturally tend to imagine that in all these cases the European species spread eastward, and gradually became modified as we find them. Yet, for anything we know to the contrary, the real origin may have been in Asia.

It is commonly said that subspecies are recognized by the fact of intergrading with the species. My conception is that they arise under conditions of isolation, for various reasons, and when it happens that they spread, so that the ranges of two races meet, hybrids are formed.[1] Can we use this appearance of hybrids as a means of distinguishing species from subspecies? If so, it would appear to lead us to an illogical position. We should have to say that A became differentiated from B and was a true species, until their ranges met, when the appearance of intermediates reduced it to subspecific rank. I have myself argued in the past that insular races must be treated as species because, in the nature of the case, hybridisation does not take place and intermediates are not found. Yet such races may differ only in very minor characters, and I now concede that they may better deserve subspecific rank.

The subspecies is an incipient species, and no one can, in his practical work as a taxonomist, definitely determine the appropriate category in all cases. Yet with experience I believe it is commonly possible to reach reasonable conclusions, and in very many cases specific validity cannot be questioned. The structural characters, as those of the genitalia, are decisive when marked differences are found.

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[1] An admirable discussion of subspecies (unfortunately called varieties) appears in Kinsey's 'Gall Wasp genus *Cynips*,' received since the above was written. All students of Hymenoptera should read this work.

Mutations among the bees are not as generally recognized by name as among Lepidoptera. It is principally in *Bombus* that we find marked variants, apparently exhibiting Mendelian inheritance. They are inconstant and likely to be heterozygous. Yet we may suppose that from time to time they become the dominant and eventually the sole type in a region, and then attain subspecific rank. It is well known among Lepidoptera that a form may be racial in one locality and appear only as an aberration in another.

Some of the particular problems needing study in our region are the following:

(1). We have evidence of the intrusion of the fauna of the Mississippi Valley in the eastern part of Colorado and of Pacific-coast elements in Utah and parts of Colorado and Wyoming. In New Mexico a southern element (e.g., *Centris*) appears and even spreads north into Colorado to some extent (e.g., *Exomalopsis*). Collecting in special regions, for the elucidation of these matters, is very desirable.

(2). It is really scandalous that we know nothing of the host relations of our very numerous species of *Nomada*. We also need studies of our other parasitic bees. Why are the epeolines so extremely numerous with us?

(3). Although so many species of *Osmia* have been described, there are many of which we know only one sex. Biological observations are greatly needed to associate the sexes. The genitalia have been studied and figured by Miss Sandhouse, but her work has not yet been published.

As this is written in the hope that it may be useful to future students, I venture to add some suggestions for a beginner.

Those who begin to collect insects commonly desire more than anything else to get them identified. This is natural and reasonable, since the names make it possible to find out what is known concerning the species. Among the bees, however, it is hardly profitable to begin this way. Our bee-fauna as a whole is still very imperfectly known, and the best treatment now possible would be extremely inadequate, except in the case of *Bombus* and a few of the small genera. The specific characters of bees are often very subtle, and we are constantly discovering characters previously overlooked. The student is thus likely to make very superficial and largely worthless determinations, or give the matter up and appeal to a specialist. But the specialist, except in a few genera, cannot name the species offhand and does not feel justified in putting aside his own work to conduct researches for another, who sometimes even expects to describe the new species which have been worked out for him. If this sounds rather unsympathetic, let it be said that the possession of a named set of bees does not ensure accuracy of determinations or precision of knowledge if the student does not know his bees; even access to the types will not save him from numerous errors.

A better mode of approach is to collect diligently, making full notes on habits and time of flight, and then go to work to classify the species, setting forth their characters in dichotomous keys, until they are well known and understood. After all my years of labor, I still begin by making keys when handling a new lot of material, leaving the question of names temporarily out of account. When the species are thus understood, it is remarkable how much more intelligible the literature becomes, even poor descriptions usually containing significant expressions. When all this has been done, and every effort has been made to determine the species and find out their relationships, it is then entirely proper to appeal to the specialist (if one can be found) to do those things which he alone, with his greater experience and large collection, can do.

No doubt the best work for the beginner, aside from observations in the field, is in morphology. It requires years to become a competent taxonomist, and involves the gathering of a large library and collection. But morphological studies can be made by any clever and diligent person who has good eyes and knows how to draw. Even the drawing may not be necessary, if photographic methods can be used. Such morphological studies, especially when done under advice, will reveal new or little-known structures, will assist in the determination of species, and will in many ways aid in classification, though their utilization requires the guidance of an experienced person.

The study of wild bees is an excellent occupation for the amateur, who can carry it on through many years. It takes him into the wilds, and gives him healthy exercise, not without excitement, during the summer.[1] When the bees are not flying, he has his collection to study, and he must be a poor collector if he cannot get enough in a summer to occupy all his spare time during the winter. In the present state of the science, he has the certainty of many discoveries. Large and handsome species, quite unknown to science, may still be found even in the United States. He is indeed at a disadvantage, in so far as there is no complete manual to which he may refer; but there is the compensating satisfaction of knowing that he is contributing to a future manual, in the pages of which his name will have an honorable place.

Bees are especially noteworthy for their interesting habits, and some very able workers prefer to concentrate on this phase of the subject, having little opportunity, and often little inclination, to enter the taxonomic field. Taxonomists should be glad to render assistance to such as these; Pérez doubtless felt it a high honor to thus assist Fabre. In other orders of insects, the aid given by Poulton to workers in the tropics has made possible the publication of many valuable contributions to biology. The student of behavior may well depend on the taxonomist for the names of his insects, but eventually he makes a return, inasmuch as his observations contribute to our understanding of families, genera and species.

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[1] As an example of what we may term the dramatic aspects of bee collecting, Mr. P. H. Timberlake had collected about 340 species of bees at Riverside, California, but had never found *Bombomelecta*. On April 4, 1930, he took two species of *Bombomelecta* in less than two minutes!

Students of geographical distribution, without being specialists in the study of bees, can make good use of records in their statistical work. It is hardly to be expected that any one will work up a collection solely for this purpose, but it is at any rate a useful by-product of taxonomic work. In my own case, having studied the bees of the regions I have visited, I find every record of a species belonging to some other group of interest, as confirming or modifying the opinions I have reached concerning the origin and nature of the biota.

Finally, there is still another group of enthusiasts, by no means to be despised. These are the collectors, pure and simple. In some cases they are specialists in the taxonomy of another group, but they are not necessarily specialists at all. We need many more collectors, to penetrate into regions yet untrod by those interested in bees. It is easy to point out many localities which are sure to yield rich returns, and the apparatus and training required make no great demands on purse or time. Such collectors should not expect complete reports, in a short time, on their discoveries. They must understand that one may catch in a few days specimens which require weeks, possibly months, of study.[1] It is discouraging to be told that the few bees obtained by Darwin on the famous voyage of the 'Beagle' have not yet been identified. It sometimes appears that the donation of collections to Museums is like throwing them into a bottomless pit.[2] But it rarely pays to collect all sorts of things at random; it is better to find out before hand what can be studied and reported on. When, as is often the case, the taxonomist cannot deal with the whole collection, he can at least report on its more interesting aspects, and show an appreciative and sympathetic attitude. I remember vividly my delight, when a very young man, on being told that I had found a variety of snail new to the British Islands; and I am not yet too old to feel a thrill of pleasure on learning that a species sent in is new to the British Museum or some other large public collection, or entirely new to science. An official letter of thanks, no matter how courteously worded, is nothing compared with the least item showing that one has actually been the means of adding to scientific knowledge.

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[1] As an illustration of what is easily possible I may cite the collection made at Victoria, Mexico, by [illegible] in Mexico, but new to the State of Tamaulipas. Many similar instances could be reported.

[2] There is one difficulty which confronts museum curators but is little understood by collectors who wonder why their specimens are not readily identified. In all large collections (especially the largest) there are many species incorrectly named, or in the wrong genus. Former curators made mistakes, and specimens have come in from many sources, determined by various people. It is utterly impossible to check up all these determinations, short of doing revisional work on the groups to which the species belong. Thus, a reliable report on a collection is a much more serious undertaking than may at first appear.

2.—*NOMIA BAKERI* CONSIDERED A SUBSPECIES OF *NOMIA NEVADENSIS*

By Beulah Hix Blair

Externally, *Nomia nevadensis* Cresson and *Nomia bakeri* Cockerell appear to be two distinct species. *N. bakeri* is nearly two millimeters longer than *N. nevadensis* and is more robust. *N. nevadensis* has a yellowish-red abdomen, whereas *N. bakeri* has a black abdomen. The mesothorax of *N. nevadensis* has coarser punctures and the tubercles are not so red as in *N. bakeri.*

Because of these external differences it was a surprise that the genitalia were identical, since the genitalia of *Nomia* have such definite specific characters. The genitalia of *N. nevadensis* and *N. bakeri* (Fig. 1) differ from those of other groups of *Nomia.* The stipites are simple in comparison. The apical portions of the dorsal flanges and ventral flanges are pointed.

The *N. nortoni* group (*N. nortoni, N. californica*) has broad dorsal flanges which bend at right angles over the dorsal side of the posterior ends of the sagittæ (Fig. 2). The Australian group of *N. australica* and *N. flavoviridis* has stipites which are very broad, but do not bend.

Small chitinous structures on the apical portion of the stipites are important for the determination of the species. *N. bakeri* and *N. nevadensis* have just a few of these. They are pointed. The *N. nortoni* group has hooked structures which have a fringe arrangement along the ends of the stipites. The Australian species, *N. australica* and *N. flavoviridis,* have numerous hooked structures, whereas the European species, *N. diversipes* and *N. ruficornis,* have ball-like structures.

The ventral plates are alike in *N. nevadensis* and *N. bakeri.* The fifth ventral plate occupies a normal position, but in the *N. nortoni* group this plate extends over the sixth ventral plate, entirely covering it.

In the *N. nevadensis* group there are two large tubercles at the posterior edge of this plate (Fig. 3). The tips of these tubercles extend outward and are covered with hairs. The *N. nortoni* group (Fig. 4) has two groups of plume-like hairs anterior to which are chitinous plates placed at right angles with this plate. The sixth ventral plate of the *N. nevadensis* group is exposed, bearing plumose hairs along the posterior edge (Fig. 5). The *N. nortoni* group has this plate without hairs (Fig. 6).

The seventh ventral plate is a ribbon-like structure curved on the posterior edge like an arch. The *N. nevadensis* group has just one pair of lobes, which look like the ends of the arches, on the posterior edge (Fig. 7). The *N. nortoni* group has two pairs of lobes (Fig. 8). In both groups these lobes bear long hairs. The species of the *N. nortoni* group are easily distinguished by the difference in the size of the plate. *N. nevadensis* and *N. bakeri* have plates of the same size.

The eighth ventral plate is the same in *N. nevadensis* and *N. bakeri* (Fig. 9). The snout-like structure, posteriorly directed, found on this plate is very sharply pointed in the *N. nevadensis* group. The *N. nortoni* group has a notch on the end of the snout (Fig. 10). The end is flat rather than pointed. The foreign groups lack a snout on this plate.

There are other similarities found in *N. nevadensis* and *N. bakeri*. The *N. nevadensis* legs are of lighter color, but they have the same size and shape. The tibiæ which have distinct individual chacteristics in this genus are exactly alike. The anterior wings of both measure nine millimeters, and the venation is identical. The color of the antennæ is the same.

One-fourth of the females of *N. bakeri* examined have the first two segments of the abdomen red. This shows that there are variations within the species.

N. nevadensis lives in the arid southwest, from New Mexico through Nevada, while *N. bakeri* represents it in the eastern foothill region of Colorado.

In view of all these facts we must conclude that *N. bakeri* is a subspecies of *N. nevadensis*, to be known as *N. nevadensis bakeri*.

Specimens from The American Museum of Natural History:

84; *N. bakeri;* ♀; Canfield, Boulder, La Junta, Colo.; F. E. Lutz.
2; *N. bakeri;* ♂; Canfied,Boulder, La Junta, Colo.; F. E. Lutz.
1; *N. nevadensis;* ♀; Las Cruces, N. M.; T. D. A. Cockerell.

From Professor Cockerell's collection:

2; *N. nevadensis;* ♂; Mesilla Park, N. M.; T. D. A. Cockerell.

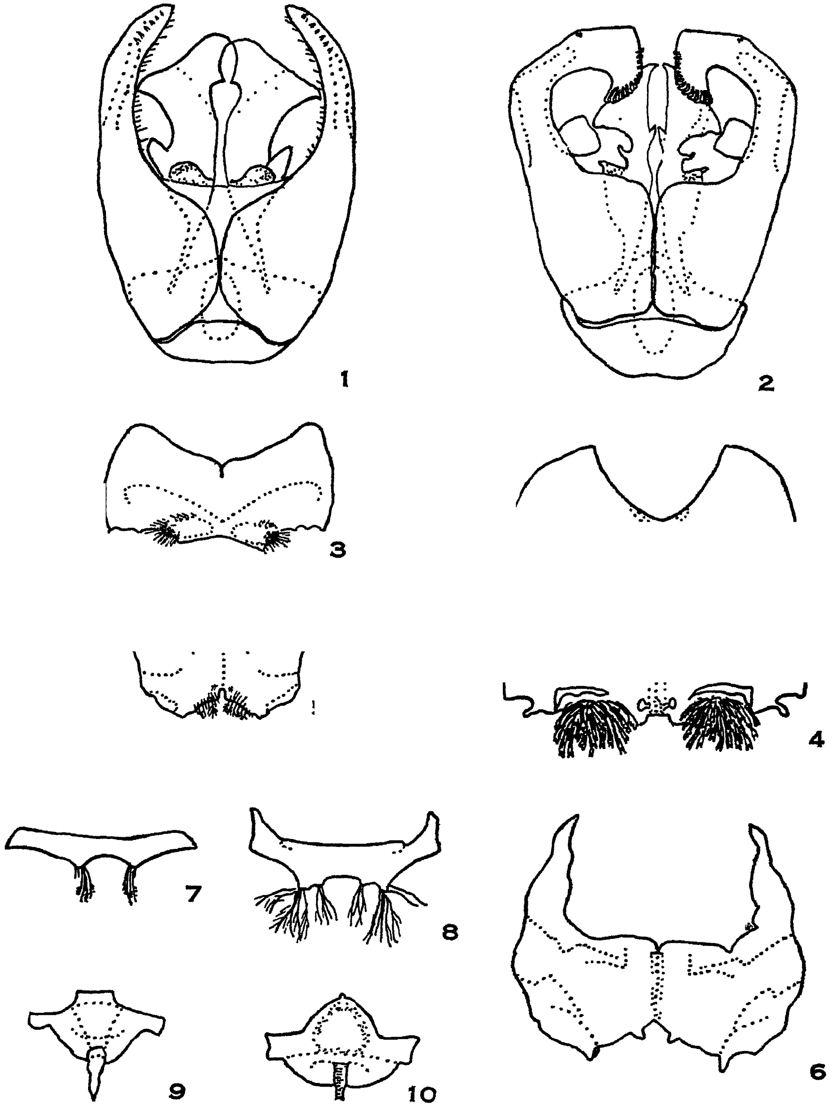

Fig. 1. Genitalia of *Nomia nevadensis* group. Fig. 2. Genitalia of *N. californica* Figs. 3–10. Ventral plates: 3, fifth, *N. nevadensis* group; 4, fifth, *N. californica;* 5, sixth, *N. nevadensis* group; 6, sixth, *N. californica;* 7, seventh, *N. nevadensis* group; 8, seventh, *N. californica;* 9, eighth, *N. nevadensis* group; 10, eighth, *N. californica.*

All of the ventral plates have the same magnification. The genitalia of *N. nevadensis* (Fig. 1) have three times the magnification of the ventral plates. Figure 2 has one and one-half times the magnification of the ventral plates. In reality the genitalia in Fig. 1 are one-half the size of the genitalia in Fig. 2. A camera lucida was used.

3.—THE GENUS *NOMIA*

By T. D. A. Cockerell

The collection from the American Museum includes six species of *Nomia* and one of *Dieunomia*, the latter being best considered a subgenus.

Dieunomia Cockerell

Nomia (Dieunomia) mesillæ (Cockerell)

A male and a female collected by Dr. F. E. Lutz at Boulder, Colorado, 5500 ft. alt., June 30, 1922, at *Petalostemon.*

The species was described from the male (Entomologist, XXXII, 1899, p. 266). The female differs in the usual sexual characters, and also has the scape red at base, the second antennal joint red; the hair on mesothorax (especially anteriorly) and postscutellum strongly suffused with fulvous; the wings smoky throughout (darkest apically) though not dark fuliginous; the short anterior tibiæ red with the apex blackened; the middle and hind tibiæ also mainly red, the hind tibiæ with a pale yellowish scopa, but black hair along hind margin; the tarsi (especially the hind ones) more or less rufescent. The abdominal hair-bands are very distinct, and the venter has stiff bright ferruginous hair. The hind margin of the first tergite is conspicuously red.

The *Dieunomia* females before me may be tabulated as follows:

1.—Hair on under side of abdomen black or gray; abdomen with or without conspicuous hair-bands.... . . . .2.
Hair on under side of abdomen pale fulvous or red. ....3.
2.—Tegulæ dark; hair of mesothorax seal-brown (Rockyford, Colo.; Gillette). *marginipennis* (Cresson).
Tegulæ pale reddish; hair on mesothorax clear rufofulvous (Victoria, Texas, at *Helianthus;* A. J. Leister)...................... .....*apacha* (Cresson).
3.—Tegulæ dark; tibiæ black (Aztec, New Mexico; C. E. Mead). *xerophila* (Cockerell).
Tegulæ translucent rufofulvous; tibiæ mainly red (Boulder, Colo.; F. E. Lutz). *mesillæ* (Cockerell).

Nomia Latreille

The type of *Nomia* is not *N. diversipes* Latreille, as I formerly supposed, but the Indian *N. curvipes* (Fabricius). This is an insect which would be placed in *Paranomia* Friese, in the broad sense, but actually there is a good deal of difference. I possess a male *N. curvipes* from F. Smith's collection. I have no typical *N. chalybeata* Smith (the type species of *Paranomia*),[1] but I have a couple of male *N. pavonura* Cockerell, collected in the Foochow district, China (C. R. Kellogg). This *N. pavonura* is a southern representative of *N. chalybeata*, and was originally described from Formosa, the type of *N. chalybeata* coming from Shanghai. There is so little difference, aside from color, that *N. pavonura* may well rank as a subspecies. The flagellum is black, and the legs also are black, with the hind tibial lobe yellow and a pallid mark on the hind basitarsi. Bingham says the legs of *N. chalybeata* are rufofulvous, but Smith does not. In the males of *N. curvipes* and *N. pavonura* the antennæ are ordinary, not narrowed and sharply pointed as in our American group of *N. nortoni* Cresson.

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[1] Designated by Cockerell (1910). Friese's other three *Paranomia* are two of them *Hoplonomia*, and one (*opposita* Smith) proves to be *Halictus*.

The following descriptions contrast the two types.

(1). *Nomia curvipes*, male (*Nomia, s. str.*).—Clypeus not carinate; stigma small, truncate, not extending far into marginal cell; third cubital cell about as broad on marginal as second; area of metathorax small, granular, dull, with no channel; hind femora extremely thick, with a strong tooth below; fourth sternite deeply and broadly emarginate.

(2). *Nomia pavonura*, male (*Paranomia*).—Clypeus longitudinally carinate; stigma rather large, pointed, extending well into marginal cell; third cubital cell about or nearly twice as broad as second on marginal; area of metathorax with a shining transverse channel; hind femora thick but without a tooth beneath; fourth sternite not thus emarginate. The tongue is very long and slender.

On this basis, we have one American species which can be associated with true *Nomia*, at least by the broadly emarginate fourth sternite, the appearance of the metathorax, and more or less on the venation. But it has two long spines on the postscutellum, and therefore should go in Ashmead's Asiatic genus or subgenus *Hoplonomia*. This species is *N. expulsa* Cockerell, labelled "Guyane, Maroni." Although I fail to identify it with any Asiatic species, I cannot help suspecting that the label is erroneous, and that it really came from some where in tropical Asia.

Our various green-banded North American forms are clearly to be placed with the *Paranomia* series, and can by no means be referred to *Nomia* proper, or to *Hoplonomia*. They can be divided into two subgenera, **Acunomia**, new subgenus, in which the male antennæ are slender and sharply pointed at the apex (type, *N. nortoni* Cresson) and *Paranomia*, in which the antennæ are not thus modified. If we regard *Paranomia* as a genus, then *Acunomia* will stand under it as a subgenus.

ACUNOMIA Cockerell

The large and handsome *Nomia nortoni* Cresson is well known. I have it from Mexico, New Mexico, and Nebraska. West of the Rockies its place is taken by another, smaller type, diverse aspects of which have been named *melanderi* Cockerell, *californica* Cockerell, *acus* Cockerell, and *paysoni* Cockerell. The long series obtained by Dr. Lutz is referred to *N. californica*, and is from the following localities:

Yellowstone Park; July 20, 1920; ♂, ♀.
Provo, Utah; July 28–29, 1920; ♂, ♀.
Rifle, Colorado; July 19–21, 1919; ♂, ♀; at alfalfa and sunflower.
Palisades, Colorado; July 18–19, 1919; ♂, ♀; at alfalfa.
Fruita, Colorado; July 16, 1919; ♂, ♀; at *Melilotus alba*.
Grand Junction, Colorado; July 17–19, 1919–Aug. 3, 1920; ♂, ♀; at alfalfa and *Melilotus alba*.
Glenwood Springs, Colorado; July 29, 1919; ♀.

The females have a green band on first tergite and are *N. californica*. The males lack this band and are *N. acus*, except for the dark tegulæ. The types of *californica* and *acus* were both labelled "Southern California." I conclude that *acus* is the male of *californica*, presenting some variation, but not separable as a race. I also conclude that *paysoni*, based on a male from Naturita, Colorado, is no more than a variation of *californica*.

N. melanderi, described from the state of Washington, is the prior name of this series. This northern form lacks the green band on first tergite in both sexes, though in the female green can be seen at the sides of the tergite. *N. californica* lacks this band in the male (i.e., *acus*). But in Lower California (Proc. Calif. Acad. Sci., XII, 1923, p. 102) both sexes have the green band. This form I now designate *N. californica* **peninsularis**, new subspecies, the type from Las Animas Bay (Van Duzee). It should be stated that sometimes the bands fail to color up properly, and in such cases the banding normal to the race may not be clearly evident.

N. melanderi is at present little known, and I treat *N. californica* as a species. But I have little doubt that more collecting in the Pacific states will show that there is only one valid specific unit, *N. melanderi*, the other forms taking subspecific rank.

PARANOMIA Friese

These insects, with ordinary antennæ in the male, have proved rather difficult to classify, and more knowledge of some of the species is greatly needed. In the collection of the American Museum I find two old specimens, male and female, collected Sept. 30, 1899, at Uvalde, Texas (J. L. Zabriskie Collection). They were presented by Professor H. F. Wickham. They unfortunately lack the antennæ, but they clearly represent different species, both differing from anything described. They are accordingly described herewith.

Nomia uvaldensis, new species

FEMALE.—Length, about 9.5 mm.; black, with broad, very pale reddish (slightly suffused with green) bands on tergites 2 to 4; no trace of a band on first tergite, but margin at sides with dense white hair; head broad, face with dull white hair; clypeus with a strong median keel; sides of front dull and excessively minutely sculptured; upper border of prothorax, tubercles, and postscutellum with much white hair; mesothorax finely and closely punctured, with thin white hair, the posterior disc with thin inconspicuous black hair; scutellum shining but well punctured, the punctures of two sizes, median depression weak; mesopleura dull, with much long white hair; tegulæ chestnut-red, with white hair anteriorly; wings hyaline, faintly dusky on apical margin; stigma ferruginous, obtuse, but projecting well into marginal cell; nervures dusky reddish; basal nervure falling distinctly short of nervulus; second cubital cell receiving recurrent nervure slightly beyond middle; third cubital long, but not very much longer than second on margnial; legs more or less rufous, the hind femora beneath, and their tibiæ and tarsi, distinctly red; hair of legs white, the scopa on hind tibiæ all white; a fulvous brush at end of hind basitarsus; abdomen dullish, very finely punctured, the first tergite dull, with distinct though fine and weak punctures; fifth tergite with very dark brown hair, white at sides; venter with white hair.

Uvalde, Texas.

From *N. mesillensis* this is readily known by the dull first tergite, and much narrower, differently colored abdominal bands. Also, the disc of mesothorax is much more closely and finely punctured. From *N. foxii* (*moctezumæ*) it is known by the absence of distinct punctures on the basal part of the second tergite, the shorter stigma, and the red tegulæ. From *N. maneei* by the quite differently colored abdominal bands, the first broader, the longer and much paler stigma, and the channel at base of metathorax granular, without cross-ridges. From *N. fedorensis* it is known by the quite differently colored abdominal bands, the lack of strong punctures on the first two tergites, and the red tegulæ. The darker, dusky-margined stigma and quite different abdominal bands show that it cannot be the male of *N. zabriskii.*

Nomia zabriskii Cockerell and Blair, new species

MALE.—Length, a little over 9 mm.; black, similar to *N. tetrazonata* Cockerell, with narrow green abdominal bands (none on first tergite), that on fourth extremely brilliant. It is perhaps to be regarded as a subspecies of *N. tetrazonata*, but it differs thus: hind femora not so stout; hind tibiæ broader; hind tarsi paler; wings paler, stigma lighter, being very pale straw-yellow; anterior middle of mesothorax duller and more closely punctured; first tergite with punctures well separated in middle above; fourth tergite more finely and closely punctured, less shining.

Uvalde, Texas.

In *N. tetrazonata* the second and third sternites are much more thickly covered with white hair. *N. zabriskii* agrees with *N. tetrazonata* and differs from *N. mesillensis* by the narrower abdominal bands, the narrower hind tarsi, and the hind tibiæ excavated in front before middle. The abdominal structures are described by Mrs. Blair in the next section.

Nomia universitatis Cockerell

FEMALE.—Boulder, Colorado; June 30, 1922. MALE.—Colorado Springs, Colorado: Sept. 15, 1896 (H. F. Wickham).

So far as I am at present able to determine, *N. moctezumæ* Crawford is identical with *N. foxii* Dalla Torre (*punctata* Fox); but Fox's "variety" of *N. punctata* is *N. universitatis.*

Nomia howardi Crawford

Based on a single female, about 9 mm. long, from San José de Guaymas, Mexico (L. O. Howard). *N. howardi vanduzeei* Cockerell was based on a female, 10 mm. long, from Loreto, Lower California (Van Duzee). I noted of the latter that it was much smaller than *N. californica,* the abdominal bands much paler, the second to fourth not nearly so broad, the antennæ differently colored (flagellum bright ferruginous beneath), tegulæ redder, and base of second tergite with larger punctures. As the male is unknown, and I have at present no material of either *howardi* or *vanduzeei*, the position of this species in the classification remains somewhat ambiguous, though it is certainly valid.

EPINOMIA Ashmead

There appears to be no sufficient reason why the group of *Nomia nevadensis* Cresson should not be merged in *Epinomia,* though the type of the latter (*N. triangulifera* Vachal) is very distinct. It is evident that the ancestors of *Epinomia* reached America quite independently of the *Paranomia* series.

The group of *Nomia nevadensis* presents a series of forms, in different parts of the country, so closely related that they may well be considered of subspecific rank. These are as follows:

N. nevadensis Cresson.—From Nevada to New Mexico, in the latter state going as far North as Santa Fé.

N. bakeri Cockerell.—Described from Fort Collins, Colorado, and widely distributed in that state east of the mountains. It was taken by Lutz at Boulder, White Rocks, Canfield and La Junta, the dates being July 30 to Aug. 15. Variety **rufibasis,** new variety, has the first two tergites, or sometimes only the first, red. It was taken at Boulder, Aug. 7–12, 1919 (Lutz), occurring commonly with ordinary *N. bakeri.* There is a smaller specimen from La Junta, Aug. 12, 1920 (Lutz), but it also occurs with ordinary *N. bakeri.* Whether the *nevadensis* and *bakeri* forms meet anywhere between La Junta and Santa Fé is not known; but should they do so, they might be expected to hybridize, as Mrs. Blair has shown that the genitalia are quite the same.

N. pattoni Cockerell.—Mississippi, Alabama and Texas.

N. arizonensis Cockerell.—Arizona. The female differs from the others of the series by the short, strongly fluted area of metathorax, and has the best claims to be regarded as a separate species.

N. angelesia Cockerell.—California. Concerning this and the latter, see Pan-Pacific Entomologist, 1925, p. 179.

The following key will facilitate the determination of American *Nomia.*

1.—Margins of tergites (often excepting first) with light tegumentary color-bands, usually green.... ....2.
Margins of tergites without such bands...... ....22.
2.—Males...... ....3.
Females. . ...13.
3.—Anterior wing about 13 mm.; first tergite densely punctured dorsally, without a green band; tergites 2–5 with emerald green bands; antennæ slender and sharply pointed at end. . . ..*nortoni* Cresson.
Anterior wing much shorter. . ... 4.
4.—Antennæ at apex elongate and sharply pointed; abdomen with green bands .5.
Antennæ ordinary, not sharply pointed at apex..................... ..8.
5.—First tergite with an entire green band; bands flushed with vermilion (Lower (California)...................... *californica peninsularis* Cockerell.
First tergite without a green band..................................6.
6.—Flagellum more robust; abdominal bands suffused with lilac.
melanderi Cockerell.
Flagellum less robust..... ....7.
7.—Bands very bright green... .. ..*californica* Cockerell (*acus* Cockerell).
Bands yellowish green, flushed with orange. .*californica* var. *paysoni* (Cockerell).
8.—Hind tibiæ reddish, excessively produced on inner side; bands (on tergites 2–5) pale, only very slightly greenish; tegulæ large......*expulsa* Cockerell.
Hind tibiæ otherwise; species smaller ....9.
9.—Hind tibiæ black, without an apical, pale lobe; bands (on tergites 2–5) flushed with blue; flagellum bright ferruginous beneath (Texas).
fedorensis Cockerell.
Hind tibiæ with a pallid lobe or lateral extension.......................10.
10.—Hind femora and tibiæ clear red; wings yellowish (Cuba). .*robinsoni* Cresson.
(*N. wickhami* Ashmead occurs in the Bahamas, and has much more black on tibiæ. See Proc. U. S. Nat. Mus., XXXVIII, 1910, p. 297, for details.)
Hind femora and tibiæ dark brown or nearly black, except tibial lobe......11.
11.—Flagellum clear ferruginous beneath; abdominal bands narrow (Arizona).
tetrazonata Cockerell.
(For the related *N. zabriskii*, see above. *N. maneei* Cockerell is easily separated from *N. tetrazonata* by the much less robust hind femora.)
Flagellum dark, obscurely reddish beneath.............................12.

12.—Hind femora hardly swollen; abdomen very coarsely punctured. *universitatis* Cockerell.

Hind femora greatly swollen; abdomen less coarsely punctured. *mesillensis* Cockerell.

(If flagellum rather strongly red beneath (some *mesillenis*), distinguished from *tetrazonata* by larger size and much broader abdominal bands).

13.—Anterior wings about 12.3 mm.; no band on first tergite. . . . . .14.

Anterior wings much shorter. . . . . .15.

14.—Bands green; wings strongly reddened. . . . . *nortoni* Cresson.

Bands ferruginous; wings hyaline with broad dusky margin. *nortoni plebeia* Cockerell.

15.—First tergite with a green band. . . . . .16.

First tergite with no green band. . . . . .17.

16.—Larger; hair of thorax anteriorly pale fulvous or white (the latter from Riverside, Calif., at *Polygonum lapathifolium;* Timberlake). *californica* Cockerell.

Smaller (for particulars see above). . . . . *howardi* Crawford.

17.—First tergite dorsally smooth and impunctate. . . . . . . *mesillensis* Cockerell.

First tergite dorsally evidently punctured. . . . . .18.

18.—Bands extremely brilliant green, the third flushed with purple; flagellum bright ferruginous beneath. . . . . *fedorensis* Cockerell.

Bands not thus brilliant; flagellum dark or dusky reddish beneath. . . . . . . .19.

(If flagellum lighter beneath (*maneei*), distinguished from *fedorensis* by the lighter tegulæ and much more weakly punctured first tergite.)

19.—Larger; first tergite conspicuously elevated before the apical depression; second also with a smooth swelling before the depression; extreme sides of first tergite showing green. . . . . *melanderi* Cockerell.

Smaller; first two tergites not thus modified. . . . . .20.

20.—Larger, punctures of abdomen very large and coarse; wings very dark. *universitatis* Cockerell.

Smaller; punctures of abdomen small or weak. . . . . .21.

21.—Disc of third tergite with conspicuous punctures (New Mexico). *foxii* Dalla Torre (*moctezumæ* Crawford).

Disc of third tergite with excessively minute dense punctures (North Carolina). *maneei* Cockerell.

Disc of third tergite impunctate in middle, with conspicuous punctures at sides; middle of second tergite basally hardly at all punctured (with conspicuous punctures in *foxii*). . . . . *uvaldensis* Cockerell.

22.—Abdomen wholly or mainly red. . . . . *nevadensis* Cresson.

Abdomen wholly or mainly black. . . . . .23.

23.—Legs at least mainly red. . . . . .24.

Legs dark. . . . . .25.

24.—Larger. . . . . *nevadensis bakerii* Cockerell.

Smaller and more finely punctured. . . . . *nevadensis pattoni* Cockerell.

25.—Larger; anterior wing about 10 mm. . . . . .26.

Much smaller. . . . . .27.

26.—Wings orange, with dusky apical region; tegulæ clear rufotestaceous (Texas). *bolliana* Cockerell.

Wings hyaline, little dusky; tegulæ darker; second recurrent nervure more remote from outer intercubitus than first from second intercubitus (the reverse is true of *bolliana*) .. .. *triangulifera* Vachal.

27.—Flagellum of male ferruginous beneath, the color abruptly contrasting with the black, which occupies two-thirds of the circumference. *nevadensis arizonensis* Cockerell.

Flagellum of male very dark reddish beneath, the red shading into the black (as in typical *nevadensis*)... . . . . *nevadensis angelesia* Cockerell. (In the female, *arizonensis* differs from others of the *nevadensis* group by the short, strongly fluted area of metathorax.)

In the above table, I have purposely used such expressions as "larger" and "smaller," without giving the actual dimensions. The student is invited to consult the original descriptions for these. Tables are extremely useful aids to taxonomy, but we must deplore a common tendency to use them alone, without taking the trouble to read the descriptions. The most the table can do is to create a strong presumption of identity, when we are dealing with a fauna which is only partly known.

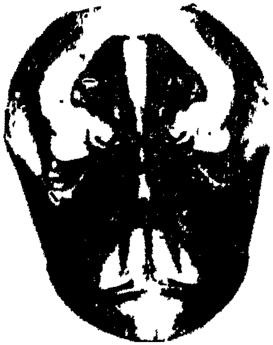
4.—ABDOMINAL STRUCTURES OF *NOMIA ZABRISKII*

By Beulah Hix Blair

Nomia zabriskii Cockerell and Blair belongs to the same group as *N. nortoni* Cresson, *N. californica* Cockerell, and *N. universitatis* Cockerell. The male genital armatures are similar in shape. The apical portions of the dorsal flange of the stipites are wide and reach beyond the sagittæ. They bend at right angles over the dorsal side of the ends of the sagittæ. The ventral and median flanges are present in these four species.

All of these species have small chitinous structures on the apical portion of the dorsal flange. They are arranged as a fringe. *N. nortoni*, *N. californica* (Fig. 11) and *N. universitatis* (Fig. 12) have these fringe structures at the end of the stipites on that region bent forward over the dorsal side of the sagittæ. *N. universitatis* has fewer and shorter structures than have *N. nortoni* and *N. californica*. *N. zabriskii* (Fig. 13) has the fringe-like structures attached at the side of the bent portion—that side away from the sagittæ. The structures point towards the sagittæ lying across the surface of this region of the apical portion. *N. zabriskii* has short blunt structures on the inner surface of the stipites opposite the widest region of the sagittæ.

All four of these species have sharply pointed structures on the outer side at the very posterior tip of the apical portion of the stipites. About six are arranged in a line. They are placed closely together.



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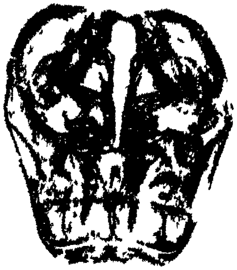

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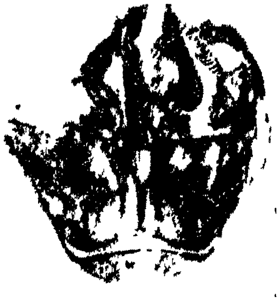

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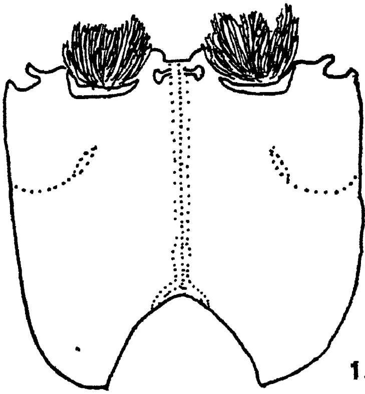

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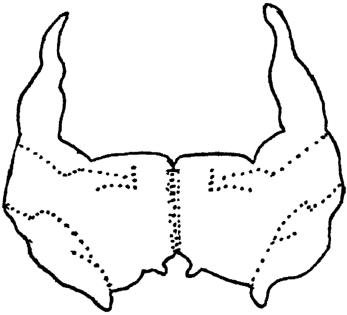

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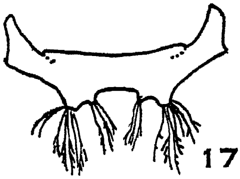

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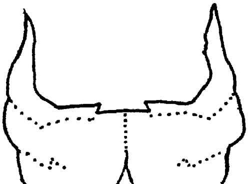

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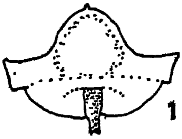

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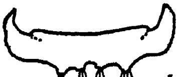

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Figs. 11 to 13. Genitalia of *Nomia*. 11, *N. californica;* 12, *N. universitatis;* 13, *N. zabriskii.*

Figs. 14 to 19. Ventral plates: 14, fifth ventral plate of *N. californica;* 15, sixth ventral plate of *N. californica;* 16, sixth ventral plate of *N. zabriskii;* 17, seventh ventral plate of *N. californica;* 18, seventh ventral plate of *N. zabriskii;* 19, eighth ventral plate of *N. californica.*

For the drawings, a camera lucida was used. The magnification is the same for all of the ventral plates.

Of other *Nomias* that I have examined, none have the bent apical portions of the dorsal flange; not all of them have the median flange; and none have the fringe-like arrangement of the structures.

The ventral plates of *N. nortoni*, *N. californica*, and *N. zabriskii* are alike except in size. The sixth ventral plate of *N. nortoni* is 4 mm. wide, that of *N. californica* 3 mm. wide, and that of *N. zabriskii* 2 mm. wide. The other ventral plates have the same proportion.

The fifth ventral plate of these species cover the sixth ventral plate (Fig. 14). On the posterior edge of the fifth plate are two groups of thick hairs arranged as plumes. They are very conspicuous. The hairs are split at the ends. Those near the median line have a bulge from which several branches spring.

Anterior to each group of hairs is a sheetlike, chitinous structure placed at a right angle with the plate. On the median line, almost between the groups of hairs, are two very narrow, long, chitinous structures extending downward at a right angle to the plate.

The sixth ventral plates (Figs. 15 and 16) are alike in structure. They are bent in a manner which probably bears some relation to the organs within.

The seventh ventral plates of these species have two pairs of lobes on the posterior edge (Figs. 17 and 18). Long plumose hairs extend from each lobe or point. Some of the *Nomia* that I have examined have but one pair of lobes.

The snout-like projection on the eighth ventral plate has a notch (Fig. 19). This is not true of some of the other *Nomia* that I have studied.

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MITES OF GENUS *DINOGAMASUS* (*DOLAEA*) FOUND IN THE ABDOMINAL POUCH OF AFRICAN BEES KNOWN AS *MESOTRICHIA* OR *KOPTORTHOSOMA* (XYLOCOPIDÆ)[1]

By Norma LeVeque

Dinogamasus Kramer (*Dolaea* Oudemans, *Paragreenia* Cockerell) is a genus of Acarina living commensally with carpenter bees of genus *Mesotrichia*, which have a pouch in the first abdominal segment. These bees are found only in the tropical or semitropical regions of the Old World, as Africa, south and east of the Sahara, the Oriental tropics, such as the Indo-Malay region and the tropical islands as far east as the Philippines; which regions thus define the known distribution of the mites.[2]

Dinogamasus has been found in the galleries which Mesotrichian bees drill in timber, as well as in the invaginated chitinous pouch on the anterior face of the first abdominal segment of the female bees. The opening to the pouch is just dorsal to the point of connection of the abdomen and thorax. The females of almost all species of Mesotrichian bees have the pouch. The few species which do not have it have a slight groove and depression at the corresponding place where the opening into the pouch should be. It is thought that the species of *Dinogamasus* are not parasites on the bees, that is, that they are not living upon any tissues of the bees and are doing no harm, nor may they be called symbionts, if we use that term in the strict sense. It is judged that they are commensals.[3]

The mites evidently live upon excess pollen which may adhere to the back of the bees or which may litter their galleries in timber and become the fertile bed for an attacking fungus. This conclusion was reached after examining a group of unkempt *Mesotrichia bombiformis* from the Philippine Islands. A heavy growth of fungus was embedded in a matting of pollen on the thorax. The pouches in these bees were, with one or two exceptions, devoid of the mites.

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[1] The major number of specimens collected were obtained by the American Museum Congo Expedition, 1909–1915

[2] Future publications are planned which will give a survey of *Dinogamasus* of the Oriental regions, and a survey of the correlation of the distribution of all groups of species of *Dinogamasus* with the groups of carpenter bees

[3] By the term commensalism we mean an association between animals which is mutually beneficial. "It does not, however, imply an organic union such as prevails among symbiotic forms, but merely a more or less permanent association for mutual good." Lull, 'Organic Evolution.'

Dr. A. C. Oudemans, in Zoologischer Anzeiger, Vol. XXVII, No. 4, Dec. 1903, has assembled several early reports about the mites being found with the bees. He traced the earliest record to the publication by a Hollander, Mr. Brilman, in 1839, in Tijdschrift voor Nederlandsch Indie, Vol. II, pp. 360–364. Mr. Brilman called the mites "little animals," and described them as having only six legs; however, it is assumed that he did not observe correctly, and that the "little animals" were the mites of this genus. Then in 1846, Mr. H. Zollinger, presumably a German, described mites found with what he thought was *Xylocopa violacea*, but which doubtless was an Asiatic *Mesotrichia*, in Natuur-en Geneeskundig Archief van Nederland's Indie, Vol. III, p. 295. Mr. Frantzius, in 1851, in Entomologischen Zeitung, from Stettin, Vol. XII, page 236, seems to have translated Zollinger's article. However, the small-sized mite described must be of the genus *Trichotarsus*, which is commonly found on the bees or in the nests, but is quite distinct from this genus *Dinogamasus*. Dr. Oudemans also found that Mr. R. T. Maitland, a Hollander, found the mites, which he called *Gamasus saccicola*, in a sort of sack in the abdomen of *Xylocopa latipes*. This was reported in 1856 in Handlingen der Nederlandsche Entomologische Vereeniging.

Mr. R. C. L. Perkins reported the discovery of the mites with the bees in Entomologist's Monthly Magazine, Ser. 2, Vol. X, pp. 37–39, Feb., 1899. Mr. E. Ernest Green, government entomologist in Ceylon, had made a similar discovery a few months previously, but did not publish it until three years later in the same magazine, Ser. 2, Vol. XIII, Oct., 1902. Dr. J. D. Alfken, of Bremen, called Dr. Oudemans' attention to these mites and the latter established the genus *Greenia*, naming two species: *Greenia perkinsi*, 1901, in Tijdschrift der Nederlandsche, Dierkundigen Vereeniging, Ser. 2, Vol. VII, pp. 52–60, and *Greenia alfkeni*, 1902, in Entom. Berichten, VI, p. 37.

The name *Greenia* was preoccupied (Kirby, 1896). Banks, in 1904, proposed the name *Greeniella*, Proceedings of the U. S. National Museum, Vol. XXVIII, p. 56, which likewise was preoccupied (Cockerell, 1900). (Berlese gave *Greeniella* to a subgenus of *Iphiopsis* in 1913, Redia, Vol. IX, page 80.) Cockerell established the name *Paragreenia* in a footnote on page 448 of Entomological News, XVIII, 1907. Oudemans, in 1912, in Entomologischen Berichten, Vol. III, page 262, gave the name *Dolaea*, evidently not knowing of Cockerell's *Paragreenia*.

It has recently come to light that in 1898 Dr. Kramer of Magdeburg established the genus *Dinogamasus*, giving a very brief description of *Dinogamasus crassipes* (Zoologischer Anzeiger, Vol. XXI, pp. 417–418). A recently published, more detailed description of this species (Archiv für Naturgeschichte, Vol. XCII, part A, Sect. 4, pp. 112–115, 1928) has determined without question that *Dinogamasus* is the genus. Kramer's specimens were collected in 1888 or 1890 on "large bumble bees" in German East Africa by Dr. F. Stuhlmann. Two of the *Mesotrichia* (*Xylocopa*) which might easily have been the host are recorded from Stuhlmann's collection of about this time. They are: *M. conjuncta* Smith, taken at Bagamoyo, and *M. nigrita* Fabricius, from the same locality on the east coast of Tanganyika Territory (German East Africa).

From Nathan Banks, 'The Acarina or Mites,' U. S. Dept. of Agri. Report No. 108, (1915), the following summaries have been made concerning the characters of the groups to which *Dinogamasus* belongs:

PARASITOIDEA.—Distinct spiracle upon a stigmal plate on each side of body (usually ventral) near third or fourth coxæ or a little behind; palpi free; skin often coriaceous or leathery; hypostome small, without teeth; venter without furrows; body often with coriaceous shields; posterior margin never crenulate; no eyes.

PARASITIDÆ.—Palpi not enlarged at tip; spiracles situated behind coxæ III; genital aperture not or scarcely behind the hind coxæ; no anterior part of body separated by a suture.

PARASITINÆ.—Spiracles and peritremes ventral; shield or chitinous surface about anus; first pair of legs lateral to mouth opening; dorsal surface of body does not project in front of camerostome; male genital opening usually on anterior margin of sternal plate (sometimes in middle); jaws of mandibles toothed, rarely stylate or needle-like. Usually not found on animals except insects.

Kramer gave as the oustanding generic character of *Dinogamasus* the absence of the peritreme, but he described and figured a lance-shaped shield which extends anteriorly from the chitinized ring surrounding the spiracle. He did not name this structure. This shield is called a peritreme by Tragardh in his description of *D.* (*Greenia*) *sjöstedti*, 1904. Oudemans, in his original description of this genus (*Greenia perkinsi*, 1901) also emphasized the absence of a peritreme. However, in a late publication (*Dolaea schoutedeni* and *D. collarti*, 1929) he calls the circular plate around each of the spiracles the peritreme, and the shield extending forward, the peritrematalium. Vitzthum calls the anteriorly directed plate the peritrematale, "obwohl die Peritremata selbverständlich fehlen," ("although of course the peritremes are lacking").

I shall call the circular shields surrounding the spiracles the stigmal plates, and shall call the anteriorly directed chitinized shields peritrematalia.

The peritrematalia are very distinct and of definite form on most species but they may be quite indistinct because of poor chitinization and may be entirely lacking on some species.

Other generic characters are as follows: the fixed digit is often shorter than movable digit; one pair of claws on all pretarsi; certain hairs on legs I and II are modified to stubby, blunt, heavily chitinized, swollen structures which are herein called "blunt cones"; stigmal plate is about twice as long as broad, sometimes only slightly longer than broad; coxæ have two spines on legs I, II, III, and one on IV.

The African forms of *Dinogamasus* are quite distinct from the species of the Oriental tropics. There is a similarity in the range of sizes, as well as in diversity of structural features, but the species of the two regions are quite distinct, just as the species of their "host" fall into groups in the two major regions.

Specific characters are based especially on the number and arrangement of cones on legs I and II, as well as on the size and shape of the body and the dorsal shield and the three ventral shields, on the form of the mandibles, and on the length, number, and arrangement of hairs on the body.

Variations in the length of legs and in width and length of body will be found among specimens taken from the same bee. This may be due to individual variations among the animals, or to the manner in which the legs are spread and to the compression of the cover-glass flattening the body.

The specimens were prepared for study as follows:

1. Placed in a strong solution of KOH until the soft parts were cleaned away and only the chitinous exoskeleton left. Time: cold method, 24 hours; but if heated almost to boiling point, 15 minutes or more. The cold method is much preferred.
2. Washed in water to remove all traces of KOH.
3. Placed in 50 per cent alcohol for 30 minutes, then into 100 per cent alcohol for an hour.
4. Placed in xylene for an hour or longer.
5. Usually two specimens were placed in thin balsam on a slide; the mouthparts of one were separated from the body in order to show the mandibles, and the other specimen was well spread out before the cover-glass was slipped into place.

Unless otherwise stated the mites have been taken from bees obtained by the American Museum Congo Expedition, 1909–1915. Types of new species of *Dinogamasus* herein recorded, as well as specimens from different localities and from different hosts, are deposited with The American Museum of Natural History, New York City. Paratypes will be found at the National Museum, Washington, D.C.

The following species of *Dinogamasus*, found on Mesotrichian bees (and on a bat), have been previously described:

Dinogamasus crassipes Kramer, 1898. Nymph; on "bumble-bee-like" specimens collected by Dr. F. Stuhlmann, 1888 (1890?), German East Africa. A meager description, merely sufficient to establish the genus. Zool. Anzeiger, XXI, pp. 417–418.

1928. A posthumous description, published by Oudemans, giving more details. Archiv für Naturgeschichte, XCII, Abt. A, Heft 4, pp. 112–115.

Greenia perkinsi Oudemans, 1901. Until 1929 considered the type of the genus "Wander-nymph," on *Koptorthosoma tenuiscapa*, Java and India. Tijdschr Nederland. Dierk. Ver., VII, pp. 60–62, Pl. II, figs. 30–35.

1912. *Greeniella perkinsi* Vitzthum. Called a nymph. Zeitschrift für wissenschaft. Insektenbiol., VIII, pp. 95–96.

1919. *Dolaea perkinsi* (Oudemans). Called a female and redescribed by Vitzthum in Archiv fur Naturgesch., LXXXV, Abt. A, Heft 5, pp. 5–7.

Greenia alfkeni Oudemans, 1902. Nymph; on *Koptorthosoma æstuans*, Malacca, India. Merely established in Entom. Berichten Nederland. Ver., VI, p. 37.

1903. A detailed description and again called "n. sp." in Tidschr. v. Entom., XLV, pp. 126–128, Pl. x, figs. 1–5.

1912. *Greeniella alfkeni* Vitzthum. Called a nymph, in Zeitschrift für wissenschaft. Insektenbiol., VIII, p. 94.

1919. *Dolaea alfkeni* (Oudemans). Redescribed and called a female by Vitzthum in Archiv fur Naturgesch., LXXXV, Abt. A, Heft 5, pp. 8–10.

Greenia sjostedti Tragardh, 1904. Nymph and female; on *Xylocopa nigrita*, Kameroon, West Africa. Entom. Tidskrift, XXV, pp. 151–156.

1919. *Dolaea sjöstedti*, discussed by Vitzthum in Archiv für Naturgesch., LXXXV, Abt. A, Heft 5, pp. 16–17. (Probably = *Dinogamasus crassipes* Kramer. See page 6.)

Greenia jacobsoni Berlese, 1910. Female; on *Xylocopa æstuans*, Java. Redia, VI, Fasc. 2, p. 263.

1919. *Dolaea jacobsoni*. Discussed by Vitzthum in Archiv für Naturgesch., LXXXV, Abt. A, Heft 5, p. 17.

Greenia hirtissima Berelese, 1910. Female; on a bat, *Pteropus edulis*, Batavia, Java. Redia, VI, Fasc. 2, p. 263.

1919. *Dolaea hirtissima*. Discussed by Vitzthum in Archiv für Naturgesch., LXXXV, Abt. A, Heft 5, p. 18.

Dolaea braunsi Vitzthum, 1914. "Nymph of the first form"; on *Xylocopa caffra* and *Koptorthosoma nigrita*, Willowmore, Cape Colony, and Amani, German East Africa. Zool. Anzeiger, XLIV, pp. 315–318.

1919. Considered a female and redescribed by Vitzthum in Archiv für Naturgesch., LXXXV, Abt. A, Heft , pp. 10–13.

Dolaea maxima Vitzthum, 1919. First called *Dolaea braunsi*, "nymph of the second stage," by Vitzthum in Zool. Anzeiger, XLIV, pp. 318–320, 1914: found on *Koptorthosoma nigrita*, Amani, German East Africa.

In 1919, Vitzthum decided this was not a form of *braunsi*. He called it *Dolaea maxima*, female; Archiv für Naturgesch., LXXXV, Abt. A, Heft 5, pp. 13–17. (Doubtless = *Dinogamasus crassipes* Kramer. See page 6.)

Dolaea amaniensis Vitzthum, 1919. Male and female; on *Koptorthosoma nigrita,* Amani, German East Africa. Archiv für Naturgesch., LXXXV, Abt. A, Heft 5, pp. 18–20.

Dolaea affinis Berlese, 1918. Female; on *Xylocopa* sp., Italian Somalia. Redia, XIII, pp. 131–132.

Dolaea villosior Berlese, 1918. Female; on *Xylocopa nigrita,* Blantyre, Nyasaland. Redia, XIII, p. 132.

Dolaea vitzthumi Oudemans, 1926. "Nymph of the third stage" and female; on *Koptorthosoma* sp., Buitenzorg, Java. Entom. Berichten, VII, p. 144. First called *Dolaea affinis* Oudemans, 1926. Entom. Berichten, VII, p. 68.

Dolaea collarti Oudemans, 1929. On *Koptorthosoma nigrita,* Stanleyville, Congo. Entom. Berichten, VII, p. 422.

Dolaea schoutedeni Oudemans, 1929. On *Koptorthosoma nigrita,* Belgian Congo. Entom. Berichten, VII, p. 423. (See *Dinogamasus crassipes,* below.)

After examining many groups of mites taken from different bees of the same species, both from the same locality and from every locality from which the bee had been collected, I found only the same species of *Dinogamasus* present (with the exception that *Mesotrichia caffra,* from Rikatla and Seychelles, had a species[1] different from the *D. braunsi,* specimens sent me by Vitzthum "from *caffra,* Willowmore"). Six very closely related species of *Mesotrichia* of the *flavorufa* group had the one species, *D. villosior,* present. The several new species belonging to the *braunsi* group were taken from small and medium-sized bees which show sexual dimorphism, the males having short yellow hairs on the black integument, giving an olive-green color, the females being black and usually having distinctive bandings of yellow or white hairs.

Dinogamasus crassipes Kramer

Specimens of *Mesotrichia nigrita* obtained by the Congo Expedition from Malela, Zambi, Stanleyville, Gamangui, Avakubi, and Niangara, which are localities ranging from the estuary to the headwaters of the northwest tributaries of the Congo River, and from Kilimandjaro, German East Africa, and specimens taken from *M. conjuncta* from Kilimandjaro, collected by W. L. Abbott (Amer..Mus. specimen), had the same species of *Dinogamasus* present.

This has led me to believe that the several large-sized mites, *Dinogamasus crassipes* Kramer, *Greenia sjöstedti* Tragardh, *Dolaea maxima* Vitzthum, and possibly *Dolaea schoutedeni* Oudemans may be synonymous. They are all recorded from the one host, *M. nigrita.* The measurements of length and width of the mite and the general descriptions of its body compare favorably, but the listing of the number of

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[1] *Dinogamasus cockerelli,* new species.

Dinogamasus crassipes Kramer

Hosts
M. nigrita
Kilimandjaro
Belgian Congo
M. conjuncta
Kilimandjaro

Length: 3240μ
Width 1900μ

Leg I, 2000μ
II, 1900μ
III, 2500μ
IV, 3000μ

Tarsus I, 3 cones
Tibia I, 3 cones
Patella I, 4 cones

Tarsus II, 3 cones
Tibia II, 3 cones
Patella II, 3 cones
Femur II, 1 cone

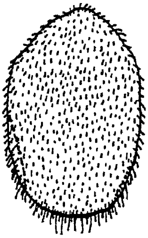


Fig. 1a
Dorsal side

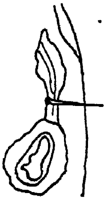


Fig. 1b
Stigmal plate and peritrematalium

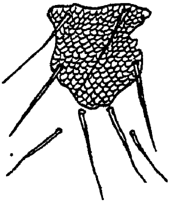
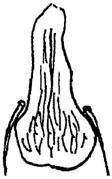


Fig 1c
Sternal shield


820μ×340μ
Fig. 1d
Genital shield

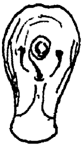

660μ×300μ
Fig. 1e
Anal shield

Fig 1f
Mandible

Dinogamasus villosior (Berlese)

Hosts:
M. flavorufa
Belgian Congo
M. combusta
Belgian Congo
Kilimandjaro
Abyssinia
M. subcombusta
Belgian Congo
M chapini
Belgian Congo
M. perpunctata
Belgian Congo
M. mixta
Benguela

Length: 1900μ-2240μ
Width: 1100μ-1300μ

Leg I, 1340μ-1560μ
II, 1160μ-1340μ
III, 1600μ-1880μ
IV, 1820μ-2100μ

Tarsus I, 3 cones
Tibia I, 3 cones
Patella I, 3 cones

Tarsus II, 4 cones

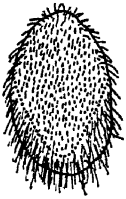


Fig. 2a
Dorsal side

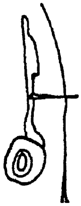


Fig. 2b
Stigmal plate and peritrematalium

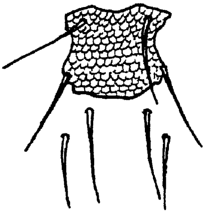
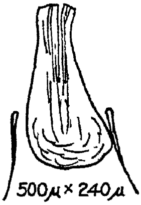


Fig. 2c
Sternal shield


500μ×240μ
Fig. 2d
Genital shield

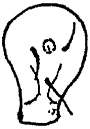

400μ×220μ
Fig. 2e
Anal shield

Fig. 2f
Mandible

Fig. 1. *Dinogamasus* (*Dolaea*) *crassipes* Kramer.
Fig. 2. *Dinogamasus* (*Dolaea*) *villosior* (Berlese).

cones on legs I and II varies among the different authors. This discrepancy may be due to the preparation of the specimens for study, for unless the specimen was cleared of the soft parts before it was mounted for examination with the microscope it would be difficult to count the number of cones on the segments; or it may be due to the fact that blunt cones and sharply pointed similar structures, which I call "heavy bristles," have not been consistently distinguished by the different workers.

The species of *Dinogamasus* which I found in all of the various specimens of *Mesotrichia nigrita* and *M. conjuncta* examined was the same as the specimen of *Dolaea maxima* Vitzthum, sent me by Dr. Vitzthum, although it did not agree with my interpretation of his description of legs I and II of *maxima* given in 1919, Archiv für Naturgeschichte, LXXXV, Abt. A, Heft 5, p. 16.

The description of *Dinogamasus crassipes* Kramer, with a few exceptions, is the same as this species. It appears to me that: (a) the "pores" described in the apical third of tarsus I may easily be the point of attachment of fine hairs which have been broken off; (b) the distal blunt cone dorsal on tibia II may be an abnormally developed cone since that position is not the usual one for such a structure, or this may be a cone accidentally broken off from some other position on the legs and accidentally placed in that position on this segment; (c) the four cones listed on tarsus II and tibia II may not all have been blunt cones, one of these "cones" may have been the thick, stiff, sharply pointed structure about the same size as the three blunt cones, which condition is found on my specimens. Since records show that Stuhlmann, the collector of the bees from which Kramer's mites were taken, recorded *Mesotrichia nigrita* and *M. conjuncta* from German East Africa at about this time, it may be safely assumed that *D. crassipes* came from one of these species.

Figure 1 shows: *a*, dorsal side of body, dots show extent of posterior part of dorsal shield; *b*, stigmal plate and peritrematalium; *c*, sternal shield; *d*, genital shield; *e*, anal shield; *f*, mandible.

In Table I is listed a comparison of this species, which was found to be the same as *Dolaea maxima* Vitzthum, with some of the other named species found on *Mesotrichia nigrita*, any or all of which may presumably be the original *Dinogamasus crassipes* Kramer.

Dinogamasus villosior (Berlese)

Berlese records this species from *Mesotrichia* (*Xylocopa*) *nigrita*, but I have not found it on *nigrita* and doubt if the host was correctly

TABLE I. Comparison of Descriptions of Species Thought to be Identical with *Dinogamasus crassipes* Kramer

My specimens: (same as specimen labelled *Dolaea maxima*) sent to me by Dr. Vitzthum Host: *M. nigrita* Kilimandjaro Belgian Congo *M. conjuncta* Kilimandjaro	Description of: *Dolaea maxima* Vitzthum Host: *M. nigrita* Amani, German East Africa	Description of: *Dinogamasus crassipes* Kramer Host: Probably *nigrita* or *conjuncta* (See p. 8) German East Africa	Description of: *Greenia sjöstedti* Tragardh Host: *nigrita* Kameroon, W. Africa	Description of: *Dolaea schoutedeni* Oudemans[1] Host: *nigrita* Stanleyville, Congo
Length: ±3240μ Width: ±1900μ	Length: 3130μ Width: 2040μ	Length: 3 mm. Width: 2 mm.	Length: 3 mm. Width: 1½ mm.	Length: 3266μ Width: 1866μ
Legs I: ±2000μ II: ±1900μ III: ±2500μ IV: ±3000μ	Given as half of actual length in original description[2]			Leg I: 2453μ II: 2200μ III: 2626μ IV: 3240μ
Blunt cones on:	Cones ("Zapfen") on:	Cones on:	Cones on:	Cones on:
Tarsus I: 3 one basal-dorsal one basal-outer one midway-outer	Tarsus I: 3	Tarsus I: 3	Tarsus I: 3	Tarsus I: 3
Tibia I: 3 two basal-dorsal one basal-outer	Tibia I: 4	Tibia I: 4	Tibia I: 3	Tibia I: 3
Patella I: 4 one midway- outer two basal-dorsal one basal-outer	Patella I: 4	Patella I: 4	Patella I: 3	Patella I: 3
			Femur I: 1	
Blunt cones on:	Cones on:	Cones on:	Cones on:	Cones on:
Tarsus II: 3 one outward on basitarsus one ventral-outer, nearer apex one outer, very near apex	Tarsus II: 2	Tarsus II: 3	Tarsus II: 3	Tarsus II: 2
Tibia II: 3 one ventral-outer-midway one dorsal-basal-outer one midway-outer	Tibia II: 3?	Tarsus II: 4	Tibia II: 3	Tibia II: no description
Patella II: 3 same as tibia II	Patella II: 3?	Patella II: 4	Patella II: 3	Patella II: no description
Femur II: 1 one ventral, less than midway	Femur II: 3?	Femur II: 1	Femur II: 1	Femur II: no description

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[1] "Indisputably these *sjöstedti*, *maxima*, and *schoutedeni* are very closely related. Careful comparison of the type is desirable in order to determine if the three are good species." Translated from Oudemans' discussion of *schoutedeni*, Entom. Berichten, No. 166, Deel VII, p. 424, March 1, 1929.

[2] Verified by Dr. Vitzthum.

determined. I have found it only on the following bees which are all closely related members of the *flavorufa* group (large robust bees with dark pubescence, dark wings iridescent with purple, green, or blue): *Mesotrichia flavorufa* from Kasonsero and from Lubumbashi, Katanga, Belgian Congo, 1921, J. Bequaert Collection; *M. combusta* from Kilimandjaro, German East Africa, W. L. Abbott, National Museum specimen, from Sagawieti, Abyssinia, and from Banana, Leopoldville, Kwamouth, and Kinshasa in Belgian Congo; *M. subcombusta* from Banana, Boma, Zambi, and Malela, all in Belgian Congo; *M. torrida* from Avakubi and from other Congo localities; *M. chapini* from Faradje and Garamba, Belgian Congo; *M. perpunctata* from Malela, Belgian Congo; and on *M. mixta* from Benguela (this latter a National Museum specimen collected by F. C. Wellman).

The mites vary somewhat in size. This may be due to the manner in which the body is spread in the balsam and compressed under the cover-glass, or to natural variation and to food supply. The largest and one of the smallest specimens were both taken from the pouch of a *M. combusta* from Sagawieti, Abyssinia. Measurements are given for comparison:

Length, 2240μ. Width, 1300μ. Legs: I, 1560μ; II, 1340μ; III, 1880μ; IV, 2100μ.
Length, 1900μ. Width, 1100μ. Legs: I, 1340μ; II, 1160μ; III, 1600μ; IV, 1820μ.

Berlese fails to mention the knife-shaped peritrematalia which extend anteriorly from the stigmal plates. More or less variation was noted among my specimens.

Figure 2 shows: *a*, dorsal side; 2*b*, stigmal plate and peritrematalium; 2*c*, sternal shield; 2*d*, genital shield; 2*e*, anal shield; 2*f*, mandible.

THE *Braunsi* GROUP

A number of slightly differing species, all with the general characters of *Dinogamasus braunsi* (Vitzthum), made it very difficult to identify the true *braunsi* until comparison was made with the specimen kindly sent me by Dr. Vitzthum, obtained from *Mesotrichia caffra* from Cape Colony. The following general characters are listed which will identify a member of this group, and then the key will help to distinguish between the several species.

Length of body: from 1.0 mm. to 2.0 mm.

Coxal spines on legs I, II, and the posterior one of leg III are enlarged. On trochanter I, ventral, a finely pointed inflated basal hair, also two blunt cones distal, the inner one usually being curved. On femur I, ventral, four short hairs (one or two species have only three), the basal one of which is often modified as a small blunt cone , and the other basal one may be enlarged at the base, forming a short, sharply pointed spine. Tarsus I with one blunt cone basal-dorsal, and two outward; patella I and tibia I with two dorsal and two outward blunt cones. Patella II and tibia II with a large "hooked" spine midway, ventral or outward, also two blunt cones outward, and a small spine midway, ventral, inward from the "hooked" spine on each segment. The large "hooked" spine found on each of these two segments is an outstanding characteristic of members of this *braunsi* group. Tarsus II with a very heavy thick apical cone and a small blunt cone ventral near apex, and a larger one outward nearer base of segment.

The hairs dorsal on legs I and II are quite heavy and long, longest on femora.

Sternal shield usually broader than long; second pair of sternal hairs are on the shield near the posterior corners. The anterior margin of the shield is often so thinly chitinized that its boundary is not easily recognized and the first pair of sternal hairs may appear to be off of the shield.

Metasternal hairs and genital pair usually as heavy as sternal hairs.

Anal shield elongate, its greatest width through anal opening. Unpaired anal hair usually midway between opening and the posterior end of shield.

Fixed digit of mandibles from one-third to two-thirds shorter than movable digit.

Frequency, length, and pattern of marginal hairs, as well as the few hairs of the central bald area of dorsal shield, will help in determining the various species. In the accompanying figures the dotted line indicates the extent of the shield on the dorsal side.

The relative size of stigmal plate varies in different species. The peritrematalia are very faintly chitinized. On some specimens of a species they may be discerned, on others not; hence it seemed hardly worth while to give full descriptions.

KEY TO SEPARATE THE NEW SPECIES OF *Dinogamasus* BELONGING TO *braunsi* GROUP

1. Ventral side of femur I with three or four unmodified sharply pointed hairs....2.
   Ventral side of femur I with one of the proximal hairs modified, forming a blunt cone or a chitinized spine.................. .. ..4.
2. Small-sized animal, only slightly over 1 mm. in length. . ...*parvus*.
   Medium sized, about 1.5 mm. in length................................. ....3.
3. Dorsal shield with not more than six pairs of hairs arranged in the median line of the bald area....................... ....*cockerelli*.
   Dorsal shield with many hairs in median line...... ....*acutus*.
4. Hairs (usually 3) ventral on tibia I as heavy as or heavier than the enlarged modified hair ventral on femur I; the five pairs of enlarged coxal spines with slightly rounding tip.... ....*inflatus*.
   Hairs ventral on tibia I slender and fine; coxal spines sharply pointed........5.
5. Femur I, ventral, with one fine hair, one blunt cone, and one spine..........6.
   Femur I, ventral, with two fine hairs, one blunt cone, and one spine..........7.
6. The outwardly placed blunt cones on leg I and all the blunt cones on leg II not showing antero-posterior flattening.......................*brevihirtus*.

All blunt cones of leg I and basitarsus II, and the very coarse apical cone of tarsus II, showing decided antero-posterior flattening . . . . *bequaerti.*

7. Anterior end of body pointed; dorsal shield pointed posteriorly and leaving a decidedly wide margin of soft skin . . . . *productus.*

Anterior end of body rounding or truncated; dorsal shield almost covering body or leaving a moderate margin of soft skin . . . . 8.

8. Small, measuring about 1.1 mm. in length; leg IV about as long as body. *oudemansi.*

Larger, measuring more than 1.5 mm.; leg IV not so long as body . . . . 9.

9. Not more than 20 hairs scattered through median area of dorsal shield; all hairs of dorsal shield short, about one-third or one-fourth the length of the marginal hairs . . . . *heteraspis.*

More than 20 hairs in median area; hairs of dorsal shield at least one-half the length of the marginal hairs . . . . *braunsi* (Vitzthum).

Dinogamasus braunsi (Vitzthum)

Specimens of *braunsi* from *Mesotrichia caffra*, Cape Colony, were sent to me by Dr. Vitzthum, whereby I was able to determine the true *braunsi* from among the several species so similar.

I found *braunsi*, varying slightly in size, on: *M. caffra mossambica*, Southern Rhodesia, collected by C. Tylor, National Museum specimen; *M. lateritia*, Tana River, Chandler Expedition, 1892–93, National Museum specimen; *M. senior*, from Usambara, German East Africa, from Benguela Hinterland, and from Kigonsera, Nyasaland.

Those from *senior* were the largest, measuring 1800μ; width, 1000μ; leg I, 1200μ; II, 1000μ; III, 1200μ; IV, 1300μ. Those from *caffra mossambica* were about 200μ less in all measurements. The specimens of *braunsi* sent by Dr. Vitzthum varied in size, but were about as large as those taken from *M. senior*.

The following features are characteristic of the species *braunsi:*

On femur I, ventral, one small blunt cone, one small sharp spine, two fine hairs. All spines on coxæ are sharply pointed.

The dorsal shield leaves a margin of soft skin extending from the second legs around the posterior end of body. Hairs on dorsal shield are rather long and soft. A bald area extends through the central region from the anterior end of the shield to midway back, and on this bald area there are only four pairs of hairs, the third pair of which is rather widespread. This bald area is followed by a median strip of slightly shorter hairs, three abreast, extending posteriorly but lacking at the posterior end of the shield, leaving a small circular bald area. See figure 3*a*.

Sternal shield poorly chitinized anteriorly.

Stigmal plate: 120μ×100μ. What appears to be a peritrematalium is faintly discernible on a few of the best prepared specimens. Genital shield with almost parallel sides; anterior margin in most specimens truncate; posterior margin slightly rounding.

Dorsal side Anal shield Mandible

Dinogamasus braunsi (Vitzthum)

Leg I, 1200μ
II, 1000μ
III, 1200μ
IV, 1300μ

Length 1800μ
Width 1000μ

Hosts
M caffra mossambica
S Rhodesia
M lateritia
Tana River
M senior
Usambara, and
Nyasaland

Femur I, (ventral)
1 cone
1 spine
2 fine hairs

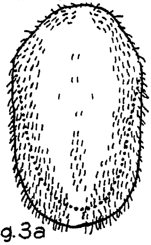
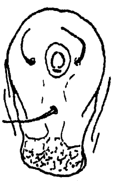


Fig. 3a


360μ × 220μ
Fig 3b

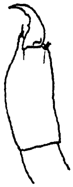


Fig. 3c

Dinogamasus acutus, n.sp

Leg I, 1100μ
II, 900μ
III, 1100μ
IV, 1260μ

Length: 1600μ
Width: 960μ

Host:
M. luteola
Belgian Congo

Femur I, (ventral)
4 fine hairs

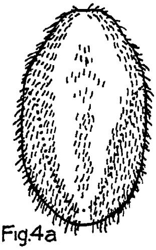
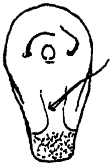


Fig. 4a


390μ × 190μ
Fig. 4b

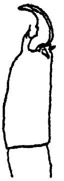


Fig. 4c

Dinogamasus brevihirtus, n.sp.

Leg I, 1100μ
II, 900μ
III, 1000μ
IV, 1100μ

Length: 1560μ
Width. 800μ

Host:
M. cloti
Belgian Congo

Femur I, (ventral)
1 cone
1 spine
1 hair

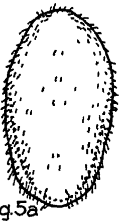
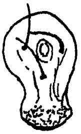


Fig. 5a


300μ × 160μ
Fig 5b

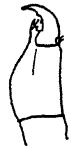


Fig. 5c

Dinogamasus cockerelli, n sp

Leg I, 1060μ
II, 900μ
III, 940μ
IV, 1020μ

Length: 1480μ
Width 760μ

Hosts.
M. caffra
Rikatla, Tana R
M incerta var.
seychellensis
Seychelles,
Indian Ocean

Femur I, (ventral)
4 fine hairs

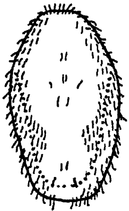
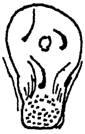


Fig. 6a


300μ × 180μ
Fig. 6b

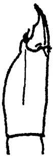


Fig. 6c

Dinogamasus inflatus, n sp

Leg I, 1100μ
II, 960μ
III, 900μ
IV, 1100μ

Length. 1600μ
Width: 880μ

Host:
M æstuans
Suez

Femur I, (ventral)
1 cone
1 spine
2 fine hairs

See text for Tibia I

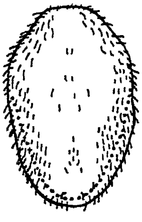
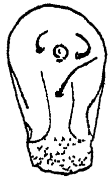


Fig. 7a


400μ × 220μ
Fig. 7b

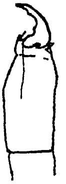


Fig. 7c

Figs. 3 to 7. Species of African *Dinogamasus* (*Dolaea*), belonging to *braunsi* group, found in *Mesotrichia* (*Koptorthosoma*).

Anal shield: 430μ×220μ (130μ at posterior edge). Surface scaled and pitted at posterior end; sides of shield posterior to the opening unevenly chitinized, in fact, corrugated; unpaired hair midway between anal opening and posterior margin. See figure 3*b*.

The fixed digit of the mandible is short. See figure 3*c*.

Dinogamasus acutus, new species

Female.—Belongs to *braunsi* group. Length: 1600μ. Width: 960μ. Legs: I, 1100μ; II, 900μ; III, 1100μ; IV, 1260μ.

On femur I, ventral, four unmodified fine hairs, the median one being the finest, the two proximal being slightly heavier.

Dorsal shield leaving a margin of soft skin around body posterior to second legs. A margin of soft hairs, five or more abreast, surrounds the body, leaving a bare central area on the dorsal shield on which about twenty hairs are arranged somewhat irregularly, followed to near the posterior part of the shield by a median strip two, three, or four hairs abreast. See figure 4*a*.

Sternal plate poorly chitinized anteriorly.

Stigmal plate: 110μ×90μ. A poorly chitinized narrow peritrematalium extends anteriorly.

Genital shield with almost parallel sides, anterior margin tapering to a point, posterior margin rounding.

Anal shield: 390μ×190μ (100μ wide at posterior edge); circular area at base pitted; lateral margins slightly more chitinized than central area. Unpaired anal hair midway between anal opening and posterior margin. See figure 4*b*.

The mandible is shown in figure 4*c*.

Holotype from Faradje, Congo.

Habitat.—*Mesotrichia luteola*, from the following localities in Belgian Congo: Faradje, Banana, Boma, Matadi, Malela, Garamba, Niangara, Lisala, Stanleyville, Coquilhatville, and Medje.

Dinogamasus brevihirtus, new species

Female.—Belongs to *braunsi* group. Length: 1560μ. Width: 800μ. Legs: I, 1100μ; II, 900μ; III, 1000μ; IV, 1100μ.

On femur I there are usually one blunt cone, one sharp spine, and one fine hair, all about the same length. One specimen was found having two short hairs besides the cone and spine, otherwise this occurrence of three structures on the ventral side of femur I could have been used for identification purposes.

The dorsal shield leaves a narrow margin of soft skin from legs II around end of body. There are only three or four rows of soft hairs around the margin of the body, those on the shield being quite short. Three or four pairs of short hairs in the central bald area; two pairs, also short, median in posterior quarter; one pair, longer, near the posterior margin of shield. An outstanding specific character is the shortness of these few hairs on the shield. See figure 5*a*.

Sternal shield about as long as wide (200μ). Margin somewhat irregular.

Genital shield: wedge-shaped, 180μ wide at posterior truncated end; anterior end with rounding point.

Stigmal plate: 140μ×100μ; no peritrematalia discernible.

Anal shield: 300μ×160μ (100μ at posterior margin, 80μ at narrowest width just above base). See figure 5*b*. Unpaired hair midway between anal opening and posterior margin. Many long hairs on ventral side surrounding anal shield.

Four of the hairs on the inner side of the next to the last segment of the palps are slightly swollen and blunt. The fixed digit of the mandible is .6 the length of the movable. See figure 5*c*.

Holotype from Stanleyville.

HABITAT.—*Mesotrichia cloti* from Stanleyville and Niangara, Belgian Congo.

Dinogamasus cockerelli, new species

FEMALE.—Belongs to *braunsi* group. Length: 1480μ. Width: 760μ–800μ. Legs: I, 1060μ; II, 900μ; III, 940μ; IV, 1000μ–1020μ.

Femur I, ventral, four fine hairs.

Dorsal shield leaving a margin of soft skin extending from the second legs around the end of the body. Hairs, relatively long and soft, three or four abreast, bordering the body, leaving the central area of the shield bare except for four pairs spread in the central part and two pairs near the posterior part of the shield. See figure 6*a*.

Sternal shield: 270μ×160μ.

Stigmal plate slightly ovate; 130μ×110μ. A poorly defined peritrematalium extends forward fusing with the shield which cups around the edge near leg II.

Genital shield: 380μ long by 100μ at posterior end. The sides almost parallel, the posterior end rounding, the anterior end, slightly spread, ending in a right angle.

Anal shield: 300μ×180μ (100μ at posterior edge). Circular area at base with fine pitting. Lateral margin of shield slightly more heavily chitinized. See figure 6*b*.

Chitinized blunt cones on legs I and II have a tendency to be flattened or even grooved, and may show a notched tip. The dorsal hairs on legs I and II are quite heavy and stout, those on legs II are longer.

The fixed digit of the mandibles is very short; the movable digit, broad through the basal half, is quite straight, and is curved slightly only near the apex. See figure 6*c*.

Holotype from *M. incerta seychellensis*, Seychelles, Mahé.

HABITAT.—*Mesotrichia caffra* from Rikatla, Delagoa Bay, collected by Junod; also *M. incerta seychellensis* from Seychelles, Mahé, Indian Ocean, collected by J. S. Gardiner, December, 1905.

Dinogamasus inflatus, new species

FEMALE.—Belongs to *braunsi* group. Length: 1600μ. Width: 880μ. Legs: I, 1100μ; II, 960μ; III, 900μ; IV, 1100μ.

On femur I, a small blunt cone, one pointed spine, two fine hairs, all short and about the same length. On tibia I, the three ventral hairs are much larger than the ventral hairs of patella I and femur I. Blunt cone on basitarsus quite heavy. Coxal spines on legs I and II and the posterior one on coxa III seem even more inflated than is usual for species of this *braunsi* group; and they have a slightly blunt tip rather than the customary finely pointed tip: the anterior spine on coxa III and the one on coxa IV are sharply pointed.

The dorsal shield leaves a narrow margin from the region of coxa III around the posterior end of the body. A border irregularly formed of three or four rows of rather long soft hairs surrounds the body, leaving a large central elongated bare area upon which four pairs of hairs are found in the anterior two-thirds of the area, and with eleven hairs arranged in the median strip in the last quarter of the body but not reaching the end of the dorsal shield. Hairs extend rather farther in on the shield in oblique rows posterior to legs IV. See figure 7*a*.

Mandibles with very short fixed digit. See figure 7*c*.

Space between pairs of legs so constricted that sternal shield, second and third pairs of sternal hairs and metasternal pair almost touch legs II or III.

Sternal shield rather evenly chitinized across anterior border.

Sides of genital shield almost parallel.

Stigmal plate: 130μ×100μ. Peritrematalium is abbreviated, triangular in form, with apex pointing toward extension of dorsal shield which extends around to the ventral side of the body near legs II and III.

Anal shield: 400μ×220μ (120μ near posterior margin). Base pitted; center of anal opening marks anterior fourth of length of shield; unpaired hair is about midway on shield; a slight furrow near lateral margins. See figure 7*b*.

Legs II, III, and IV are relatively short, the tarsal segments being very short.

HABITAT.—*Mesotrichia æstuans* from Suez, Lisht, Egypt; collected by A. Hrdlicka; National Museum specimen.

Dinogamasus heteraspis, new species

FEMALE.—Belongs to *braunsi* group. Length: 1800μ. Width: 1000μ. Legs: I, 1100μ; II, 960μ; III, 1100μ; IV, 1300μ.

Femur I, ventral, with one small blunt cone, one sharply pointed spine, and two pointed hairs.

Dorsal shield almost covers entire back, narrow margin may be seen on some specimens from near legs IV to point near the end of body. Three or four rows of hairs surround the body from near the vertex to near the posterior end. Marginal hairs rather long and soft, especially those on the soft skin; those on shield are shorter, especially those of posterior half. Four pairs of hairs on large bare area of shield; a few hairs in median line near posterior end of shield. See figure 8*a*.

Sternal shield rather evenly chitinized. Third pair of sternal hairs (on soft skin) are quite close to the posterior margin of shield.

Stigmal plate: 140μ×100μ. Peritrematalia faintly chitinized, very narrow, on some specimens abbreviated, on others found to extend to the dorsal shield cupping around body near legs II.

Anal shield: 440μ×220μ, especially heavily and unevenly chitinized with lateral corrugations in posterior portion. See figure 8*b*.

Mandible: see figure 8*c*.

Holotype from Medje.

HABITAT.—*Mesotrichia imitator* from the following localities in Belgian Congo: Poko, Avakubi, Niangara, Stanleyville, Medje, and Banana.

Dinogamasus productus, new species

FEMALE.—Belongs to *braunsi* group. Length: 1380μ. Width: 720μ. Legs: I, 950μ; II, 760μ; III, 900μ; IV, 1100μ.

The hairs around the body are rather fine and soft and are not so numerous as usually found on members of *braunsi* group, nor are the dorsal hairs on femur I and II and patella I and II relatively so long as usual.

On femur I, ventral, there are a blunt cone, a small sharp spine, and two fine hairs, the more basal of the two hairs being quite rudimentary.

The sides of the body are almost parallel; the anterior end is wedge-shaped, the posterior end broad. The dorsal shield cuts in near legs III leaving a rather wide margin of soft skin around the posterior two-thirds of the body. Four or six rows of soft hairs border the body, only two or three rows of these extend irregularly on to the lateral margin of the posterior half of the dorsal shield. Four pairs of hairs are arranged on the central bald area of the shield, and about seven pairs are scattered in the median area near the posterior end. See figure 9*a*.

The sternal shield is 210μ wide at posterior margin; the anterior margin is poorly chitinized.

The metasternal hairs are more wide-spread than second sternal pair.

Genital shield: 310μ long, 140μ wide near posterior end; sides almost parallel.

Anal shield: 300μ×150μ (100μ near posterior end). Posterior area finely pitted; lateral margins somewhat corrugated; unpaired hair midway between anal opening and posterior end of shield. See figure 9*b*. Hairs on soft skin surrounding anal shield soft and weak.

Stigmal plate: 100μ×80μ.

Mandible: fixed digit about one-half the length of the movable, the latter slender, curving in from a rather broad base. See figure 9*c*.

HABITAT.—*Mesotrichia divisa* from Umbilo, Durban, Natal; collected by A. L. Bevis, 1917; American Museum specimen.

Dinogamasus parvus, new species

FEMALE.—Belongs to *braunsi* group. Length: 1060μ. Width: 660μ. Legs: I, 880μ; II, 700μ; III, 780μ; IV, 880μ.

Body ovate, with greatest width between legs II and III; anterior end truncate. Dorsal shield covers the back except for a narrow margin from legs III around posterior end of body. A border of three, four, or five irregular rows of hairs extends around the margin of the shield from near the median anterior region to near the median posterior region. Hairs of shield are relatively long though they are not so long as those on the lateral margin of the body. Five pairs of hairs are symmetrically arranged in the median central area; six or seven hairs are distributed in two irregular rows posteriorly, but they do not reach to the posterior end of the shield. See figure 10*a*.

Stigmal plate: 100μ by 80μ—relatively large for so small an animal (compare with size of *D. acutus*).

Sternal shield is fairly evenly chitinized; margin somewhat irregular; 200μ wide by 110μ long.

Anal shield· 220μ long by 140μ wide (80μ wide near posterior end). Numerous

Dorsal side Anal Shield Mandible

Dinogamasus heteraspis, n sp
Length 1800μ
Width· 1000μ
Leg I, 1100μ
II, 960μ
III, 1100μ
IV 1300μ
Host *M imitator*
Belgian Congo
Femur I, (ventral)
1 cone
1 spine
2 fine hairs

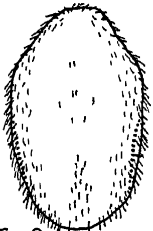
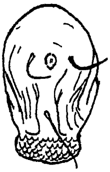


Fig.8a


440μ×220μ
Fig 8b

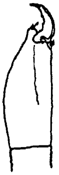


Fig.8c

Dinogamasus productus, n sp
Length 1380μ
Width 720μ
Leg I, 950μ
II, 760μ
III, 900μ
IV, 1100μ
Host: *M divisa*
Durban, Natal
Femur I, (ventral)
1 cone
1 spine
2 fine hairs

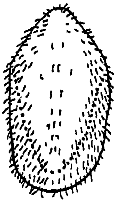
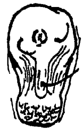


Fig. 9a


300μ×150μ
Fig 9b

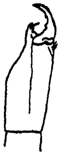


Fig.9c

Dinogamasus parvus, n sp.
Length· 1060μ
Width: 660μ
Leg I, 880μ
II, 700μ
III, 780μ
IV, 880μ
Host: *M. codinai*
Lisala, Congo
Femur I, (ventral)
3 weak, fine hairs

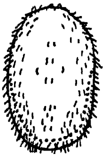
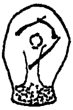


Fig. 10a


220μ× 140μ
Fig.10b

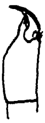


Fig.10c

Dinogamasus oudemansi, n.sp.
Length: 1100μ
Width: 700μ
Leg I, 900μ
II, 700μ
III, 900μ
IV, 1060μ
Host: *M. stuhlmanni*
Rikatla
Femur I, (ventral)
1 cone
1 spine
2 fine hairs

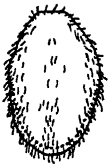
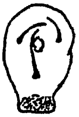


Fig. 11a


280μ×160μ
Fig. 11b

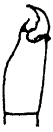


Fig. 11c

Figs. 8 to 11. Species of African *Dinogamasus* (*Dolaea*), belonging to *braunsi* group, found in *Mesotrichia* (*Koptorthosoma*).

long soft hairs, similar to the marginal hairs, are on the soft skin posterior to the hind legs.

This species may be distinguished from the other members of *braunsi* group by the presence of three fine weak hairs on ventral side of femur I, and by the following structures on ventral side of trochanter I: one curved blunt cone, one spine, one inflated hair with attenuated tip (the latter structure basal). The structures ventral on trochanter II are unmodified medium-sized spine-like hairs. The outwardly directed large cone midway on patella II and tibia II which is customarily blunt in the *braunsi* group is of the usual large robust form, but is decidedly sharply pointed. The blunt cone outward-basal on these two segments is not more than one-half the length of the sharp-pointed midway structure.

Mandibles: fixed digit is two-thirds the length of the movable digit. See figure 10*c*.

Holotype from *M. codinai*, Lisala, Congo.

HABITAT.—Found in *Mesotrichia codinai* (Dusmet), from Lisala, Congo; J. Bequaert, collector; November, 1924. (Bequaert collection.) Also found in a similar bee which might well be *codinai* but is in too poor condition for determination; from Medje, Belgian Congo, (American Museum Congo Expedition).

Dinogamasus oudemansi, new species

FEMALE.—Belongs to *braunsi* group. Length, 1100μ. Width: 700μ. Legs: I, 900μ; II, 700μ; III, 900μ; IV, 1060μ.

Leg IV almost as long as the body. The enlarged coxal spines on legs I, II, and posterior of III seem unusually large. Femur I with one blunt cone, one sharp spine, and two fine hairs.

Greatest width of body near coxæ II. Anterior end of body truncated.

Dorsal shield leaves a narrow margin of soft skin from the third legs around the end of the body. A border of long soft hairs extends around the body on to the dorsal shield. Four pairs of hairs are arranged on the central bald area; sixteen or eighteen long hairs are in the median area of the posterior third of the shield. See figure 11*a*.

Sternal shield wider than long.

Anal shield: 280μ×160μ (90μ at posterior end). Unpaired hair midway between anal opening and posterior end. See figure 11*b*. All hairs of the ventral side are unusually long and finely pointed.

Mandible: fixed digit is slightly less than one-half the length of the movable digit. See figure 11*c*.

HABITAT.—*Mesotrichia stuhlmanni*, Rikatla, Delagoa Bay; collected by Junod; National Museum specimen.

Dinogamasus bequaerti, new species

FEMALE.—Belongs to *braunsi* group. Very similar to *D. brevihirtus* by having on femur I, ventral, one fine hair, one blunt cone and one spine. It is distinguished from *brevihirtus* by its smaller size, and by the decided antero-posterior flattening of the blunt cones on leg I and basitarsus II, and by the slight flattening of the basal cone of patella II and tibia II. However, the blunt cones of *brevihirtus*, dorsal and basal on leg I, show some flattening.

Length: 1440μ. Width: 740μ. Legs: I, 1000μ; II, 800μ; III, 900μ; IV, 1020μ.

Dorsal shield almost covers entire back; a narrow margin extends from legs II to posterior end of body. A few very short hairs are found in the posterior one-fourth of the shield and are correspondingly sparing in numbers around the margin of the shield and on the soft skin, where a few longer hairs are intermingled. Through the median central area there are about four pairs of very short fine hairs symmetrically spread in the characteristic arrangement of the *braunsi* group.

Sternal shield shows poor chitinization anteriorly, so that the first pair of sternal hairs are not on the heavier portion. The posterior margin shows more or less irregular erosion. The second pair of sternal hairs are placed on the lateral margins of the shield at its greatest width (200μ). Length of shield: 190μ. Third pair of sternal hairs, 70μ apart; fourth sternal pair, 130μ apart.

Genital shield is 330μ long and 140μ wide at greatest width at rounding posterior end.

Anal shield: 270μ long, 200μ wide (100μ at posterior end); a marked lateral corrugation extends from curved region toward the posterior end of the shield; the posterior margin is heavily scaled and pitted.

The hairs on the ventral surface of the body surrounding the anal shield are long, fine, and numerous.

Stigmal plate: 130μ by 90μ.

Palpitarsus with two swollen blunt short hairs on inner side near apex. Basal hair on each maxilla similar in size and structure to the basal hair ventral on trochanter I and trochanter II.

Coxal spines are heavy, swollen and sharply pointed, and, as is characteristic of the *braunsi* group, the anterior spine of coxa III is small, the one on coxa IV is slender. The blunt cones on legs I and II are in number and position typical of members of this group, but the blunt cones on leg I are compressed, the greatest diameter being at right angles to the axis of the leg, and they are notched at the tip. The hooked spine on patella II and tibia II are large and well curved anteriorly. The basal-lateral cone on these same segments is about half the size of the midway-lateral cone on the segment, while the basitarsal cone of leg II is intermediate in size and shows compression. The coarse heavily chitinized apical cone in some views seems somewhat flattened and recurved outwardly. The midway-ventral blunt cone on tarsus II is very short—scarcely longer than broad. The modified hairs ventral on femur I will help to separate this species from other members of the *braunsi* group (except *brevihirtus*). There is a short slender blunt cone, and a finely tipped spine-like hair whose base is as large as the blunt cone, and a more slender fine hair, the last being more distal on the segment. Trochanter I, ventral, has a swollen hair with long attenuated tip, and placed more distally, a blunt cone outward and a slightly curved more stout blunt cone inward. Trochanter II, ventral, has a slightly swollen hair with a long attenuated tip, a blunt cone distal, and a stiff, more slender, sharp spine outward-midway.

Mandible: fixed digit about half as long as the movable digit. The latter is well curved and is broad at the base.

HABITAT.—On *Mesotrichia albifimbria* Vachal, from Bamania. Coquilhatville, Belgian Congo; Dr. J. Bequaert, collector; July, 1924

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TWO NEW FRUIT BATS COLLECTED BY THE WHITNEY SOUTH SEA EXPEDITION

By Colin Campbell Sanborn[1]

The Pacific Islands have recently been visited by two scientific expeditions which have obtained large collections of bats. This is the first extensive work that has been done on the Chiroptera of the region since the last century. The first of these collections was made by the Whitney South Sea Expedition of The American Museum of Natural History, which is still in the field. It contains 211 specimens embracing twenty-two species of Megachiroptera and nine species of Michrochiroptera. Not only are many of these species rare, being heretofore unrepresented in American museums, but all have added much to the knowledge of distribution.

The other collection was made by the Crane Pacific Expedition of Field Museum of Natural History during 1928 and 1929. The Whitney South Sea Expedition material was loaned to Field Museum for use in determining the Crane Pacific collection. It was found that the two collections were so interwoven that a combined report upon them would have many advantages in interest and helpfulness to future workers. Therefore, The American Museum of Natural History and the Field Museum have generously placed both collections in my hands for the preparation of such a report. The following paper, in which two species of fruit bats from the Whitney South Sea collection are described as new, is a forerunner of the complete report which will appear later in the publications of Field Museum.

I wish to thank the authorities of The American Museum of Natural History for permission to publish this paper and the future report. I am especially indebted to Mr. H. E. Anthony, Curator of Mammals, and also to Mr. Robert T. Hatt, and Mr. T. Donald Carter, of the Department of Mammals.

Pteropus banksiana, new species

Type.—No. 79986, Amer. Mus. Nat Hist.; ♂ ad.; Ureparapara or Bligh Island (13° 35′ S., 167° 18′ E., twelve miles northwest from the north point of

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[1] Assistant, Division of Mammals, Field Museum of Natural History.

Vanua Lava Island), Banks Islands, between the New Hebrides and the Santa Cruz Islands; November 16, 1926; collected by the Whitney South Sea Expedition. The type, from which the skull has been removed and cleaned, is in alcohol.

General Characters.—The smallest of the *samoensis* group; about the size of *anetianus*, but with shorter forearm. Color almost a uniform shade of brown.

Description.—Color of back and belly Prouts brown shading to lighter on rump, foreneck, head, and lower belly.

Skull with short rostrum and heavy dentition. Upper incisors strong, not touching. I_2 about two and a half or three times the bulk of i_1. Canines strong, the upper ones slightly recurved, both with strong cingulums the edges of which show faint traces of tubercles. P^1 slightly smaller than i_2 and p_1 slightly larger than i_2; p_3 with broad posterior basal ledge having its edge broken into small tubercles; p^3 with a broad posterior basal ledge and a small cusp on the anterior internal face of tooth; p^4 and p_4 have posterior basal ledges which show a tendency to break into tubercles, and also have faint internal ledges, stronger anteriorly in p^4 and posteriorly in p_4. M^1 with heavier internal basal ledge whose edges and the cutting edges of the crown are broken into faint tubercles; m_1 with tuberculated basal internal and posterior ledges; m^2 about the size of i^2; m_2 with basal and internal basal ledges; m_3 slightly larger than p^1.

Measurements.—Forearm, 117.5 mm.; pollex, total length, c. u., 51.4; pollex, metacarpal, 11.4; pollex, 1st phalanx, 26; 2nd digit, metacarpal, 59.3; 2nd digit, 1st phalanx, 15.8; 2nd digit, 2nd and 3rd phalanges, c. u., 15; 3rd digit, metacarpal, 79.1; 3rd digit, 1st phalanx, 57; 3rd digit, 2nd phalanx, 81.8; 4th digit, metacarpal, 78.7; 4th digit, 1st phalanx, 48; 4th digit, 2nd phalanx 49.8; 5th digit, metacarpal, 82.7; 5th digit, 1st phalanx, 35.8; 5th digit, 2nd phalanx, 37.8; ear, length from orifice, 20.7; ear, greatest width, flat, 12; interfemoral, 1; lower leg, 57.3; foot, c. u., 33; calcar, 16.4; front of eye to tip of muzzle, 22.6.

Skull, total length, 57; basal length, 55.3; front of orbit to tip of nasals, 16.3; brain-case at zygomata, 20.9; zygomatic width, 31.7; width across canines, externally, 11.6; postorbital constriction, 7; interorbital constriction, 7.3; orbital diameter 11; mandible length, 41.2; coronoid height, 24.7; upper teeth, c–m^2, 21.2; lower teeth, c–m_3, 22.3; upper incisors, combined width, 6.2.

Specimens Examined.—The type is the only specimen known.

Pteropus nitendiensis, new species

Type.—No. 75186, Amer. Mus. Nat. Hist., ♂ ad.; Santa Cruz or Nitendi Island, Santa Cruz Islands; February 24, 1924; collector, F. P. Drowne, Whitney South Sea Expedition. The type is a skin with skull. The skull lacks the premaxillaries, the upper incisors, and the middle lower incisiors.

General Characters.—A member of the *pselaphon* group, about the size of and closely related to *tuberculatus*, but with slightly narrower teeth and of a different color pattern.

Description.—Color of back and rump cream-buff darkened by light seal-brown bases of hairs. Mantle, neck tufts, and hairs on tibia close to Mikado brown lightened by golden tips to the hairs. Crown warm buff, bases of hairs gray. Sides of face and throat a few shades darker than the mantle. General color of the much worn breast and belly a grizzled brown.

Skull short and stout with broad rostrum and heavy dentition. Very much like *tuberculatus* except that the interorbital region is more depressed, the teeth are very slightly narrower, the upper canines do not have the cusp-like projection on the hinder trenchant margin, and the orbital diameter is larger.

MEASUREMENTS.—Forearm, 121 mm. Skull, total length to tip of nasals, 54.8; palation to incisive foramina, 27; front of orbit to tip of nasals, 15.5; width of brain-case at zygomata, 21; zygomatic width, 33; width across m^1, externally, 15.8; lacrymal width, 13.7; width across canines, externally, 12.6; postorbital constriction, 6.5; interorbital constriction, 8.5; orbital diameter, 12.5; mandible length 41.6; coronoid height, 23.2; upper teeth, c–m^2, 21.4; lower teeth, c–m_3, 23.

SPECIMENS EXAMINED.—The type and one male. The second specimen was taken at the same time as the type. It is younger, the forearm measures 116, and the teeth have been lost from the skull.

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Number 436 | Published by The American Museum of Natural History New York City | Oct. 17, 1930

59.81, 1 E (934)

HERPETOLOGICAL RESULTS OF THE WHITNEY SOUTH SEA EXPEDITION. V.[1] DESCRIPTION OF *EMOIA SANFORDI*, A NEW LIZARD FROM ISLANDS OF THE WESTERN PACIFIC (SCINCIDÆ)

By Karl P. Schmidt and Charles E. Burt

Having independently reached the conclusion that the New Hebridean lizard which has been known hitherto as *Lygosoma samoense* or *Emoia samoensis* represents a distinct and unnamed species, we have combined our notes on the new form in the following description.

Emoia sanfordi,[2] new species

Type Specimen.—A. M. N. H. No. 42957; Elephant Island, Hog Harbor, Espiritu Santo Island, New Hebrides Group; collected April 4, 1929, by Karl P. Schmidt.

Diagnosis.—A species related to *Emoia samoensis* (Duméril), from which it differs in having a larger size, 63 to 77 lamellæ under the fourth toe of the hind foot (instead of 43 to 66), and a different coloration. The back and sides are covered by smooth or feebly multicarinate scales and there are 56 to 65 scales from the occiput to the base of the tail.

Description of the Type Specimen.—Body moderately stout; head wedge-shaped, widest in the region between the orbit and the tympanum; nostril moderate, supranasals small; anterior and posterior loreals present, elongate; frontonasal large, about as long as wide, broadest posteriorly, forming a nearly straight suture with the rostral in front and an angular suture with the prefrontals behind; prefrontals well developed, in moderate contact medially; frontal much longer than prefrontals, about the same length as the large frontoparietal plate and interparietal together; interparietal small, bounded by distinct sutures; large external parietals forming a suture behind the interparietal; a large pair of nuchals and a large pair of temporals developed; four supraoculars; seven superciliaries; 10 ciliaries above the eye, 13 below; eyelids well developed, lower with a transparent disk in its center; a large upper labial below the orbit, five smaller ones anterior to this; five large lower labials and several smaller ones; a terminal mental, a postmental and three pairs of large sublabials, only the anterior pair in contact medially; longitudinal series of scales present on the throat, chest and abdomen; tympanum small, about the size of the transparent disk in the lower eyelid; three auricular lobules on one side, six on the other; dorsal scales feebly multicarinate, larger than the ventral plates; lateral scales noticeably smaller than dorsal ones; 30 scales around the middle of the body; 56 scales from the occiput to the base of the tail; 69 lamellæ under the fourth toe of the hind foot; median subcaudal scutes wider than long.

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[1] The previous contributions to this series are as follows: I. Schmidt, Karl P., 1921, 'A List of the Lizards Collected by R. H. Beck in the Southern Pacific, November, 1920, to May, 1921,' Copeia, CI, pp. 90–92; II. Schmidt, Karl P., 1922, 'Second Report on Lizards Secured by the Whitney South Sea Expedition,' Copeia, CIV, pp. 23–24; III. Ortenburger, A. I., 1923, 'Further Notes on Reptiles Collected by the Whitney South Sea Expedition,' Copeia, CXVII, pp. 59–60; IV. Burt, Charles E., 1930, 'Descriptions of New Species of Lizards from the Pacific Islands (Scincidæ),' Amer. Mus. Novitates, No. 427, pp. 1–3.

[2] This species is named for Dr. Leonard C. Sanford, honorary fellow and trustee of The American Museum of Natural History, whose interest in the Whitney South Sea Expedition has contributed very largely to its success.

Ground color bright green above, broken by scattered dark spots on single scales; sides uniform green; head black above, the black area extending to the shoulders; venter light bluish-green; soles of feet yellowish; tail grayish brown above, bluish below at base, with yellow lateral spots, grayish mottled with brown on terminal half.

MEASUREMENTS OF THE TYPE SPECIMEN.—Total length, 307 mm.; tip of snout to anus, 106 mm.; arm, 36 mm.; leg, 46 mm.; tip of snout to posterior border of ear, 26 mm.; greatest width of head, 16 mm.

The geographical variation in the number of scales around the middle of the body, the number of scales from the occiput to the base of the tail, and the number of lamellæ under the fourth toe of the hind foot, is presented by the following table.

Locality	Number of Specimens	Longitudinal Scale Rows	Scales from Occiput to Base of Tail	Lamellæ Under Fourth Toe
SOLOMON GROUP	2	28–29	57–58	75
BANKS GROUP	6	28–30	56–62	69–77
NEW HEBRIDES GROUP	30	28–32	56–65	63–75
SUMMARY	38	28–32	56–65	63–77

From these data it is evident that the specimens of *sanfordi* from the Solomon, Banks, and New Hebrides groups are essentially uniform in their variations.

The general coloration of this form is highly variable. The ground color of the back in formalin specimens is blackish, reddish, brown, greenish, bluish, olivaceous, or gray, while the underparts are pinkish, reddish, brownish, green, blue, slate, or yellowish, darker on the flanks than near the median ventral line. The back may be uniform in color, mottled with light and dark markings, or dark-spotted. In the latter instance, the dark spots may be few or many, large or small. In some examples the crown of the head is covered by an extensive dark-brown patch which may extend over most of the large cephalic plates. At the edges, this patch is irregular and broken by light areas, thus producing a mottling. In other examples, the top of the head is almost the same color as the back, or even lighter.

LIST OF PARATYPES

BANKS GROUP.—Gaua, six specimens, A. M. N. H. Nos. 40198–99, 42120–21, and 42124–25.

NEW HEBRIDES GROUP.—Ambrym, M. C. Z. No. 19609; Aoba, two specimens, A. M. N. H. Nos. 42088 and 42158; Api, two specimens, A. M. N. H. Nos. 40543 and 42152; Aurora, one specimen, A. M. N. H. No. 40172; Espiritu Santo, F. M. N. H. Nos. 13688–89 and 13700, 13702; Efáte, one specimen, A. M. N. H. No. 42005; Malekula, six specimens, A. M. N. H. Nos. 40169–70 and 40514–16, F. M. N. H. No. 13664; Tongoa, two specimens, A. M. N. H. Nos. 40544–45; Wala Id., F. M. N. H. Nos. 13667–73.

SOLOMON GROUP.—Fauro, two specimens, A. M. N. H. Nos. 40340–41.

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56 9,3 (117:51 7)

TWO NEW CRETACEOUS FRESH-WATER GASTROPODS FROM MONGOLIA[1]

By Chi Ping[2]

PREFATORY NOTE

The shells here described were submitted to me by Mr. Walter Granger who collected them in the Dohoin Usu Cretaceous beds of Mongolia.[3] I have asked Dr. C. Ping, the Director of the Fan Memorial Institute of Biology in Peking, and of the Biological Laboratory of the Science Society of China in Nanking, to prepare the descriptions and illustrations. Dr. Ping is a member of the Palæontological Staff of the Geological Survey of China, as well as a highly trained zoologist. He has undertaken the study of the fossil terrestrial and fresh-water gastropods of China. The illustrated types are deposited in the Museum of the Geological Survey in Peking, in accordance with agreement. Others (paratypes) are deposited in The American Museum of Natural History.

A. W. Grabau.
Geological Survey of China, Peking,
May, 1930.

The two gastropods of which the following descriptions are given were collected in Mongolia by Mr. Walter Granger of the Central Asiatic Expedition in 1925. Their chief features fit into the genus *Vivipara* of the family Viviparidæ, but they do not agree with any species, either fossil or living, on record. It is deemed necessary to consider them as new species.

Vivipara grangeri, new species

Text-Figs. 1–2, holotype; 3–4, mut. α; 5–9, mut. β; 10, mut. θ.

Shell of moderate size, ovoid, moderate-spired, whorls 6. Apex, in most specimens not preserved, but in some, slightly obtuse. First whorl small, low, rounded, embraced by the next up to the ambitus. Second whorl longer, with its surface slightly convex. Third and fourth whorls with surfaces more convex. Fifth still more convex than the fourth. The increase in size and degree of convexity of the surface regular and gradual from second to fifth whorl inclusive. Body whorl with sudden increase in size and convexity, its length slightly shorter than that of the spire. From the first to the fifth whorls inclusive, each following whorl is about one and one-half times the preceding one. Suture between each two successive whorls very pro-

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[1] Publications of the Central Asiatic Expeditions of The American Museum of Natural History. Contribution No. 103.

[2] Director of The Fan Memorial Institute of Biology, Peking, China

[3] Berkey, Charles P., Granger, Walter, and Morris, Frederick K. November 8, 1929. "Additional New Formations in the Later Sediments of Mongolia." American Museum Novitates, No. 385.

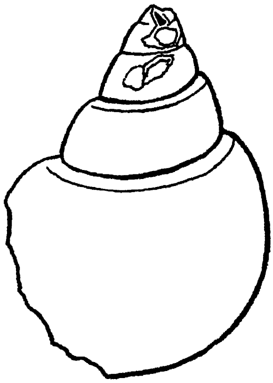


Fig. 1

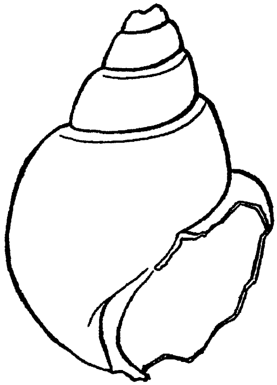


Fig. 2

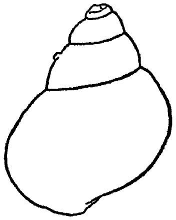
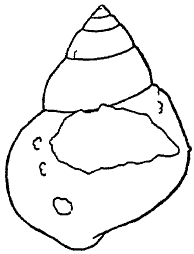


Fig. 3



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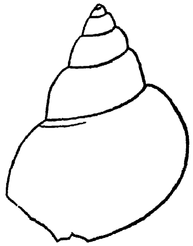

Fig. 5

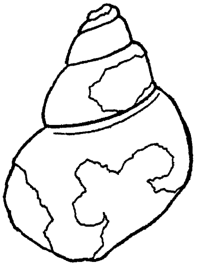

Fig. 6

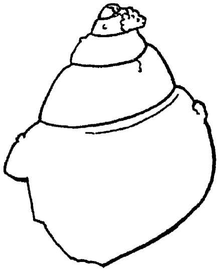

Fig. 7

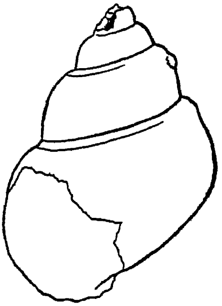

Fig. 8

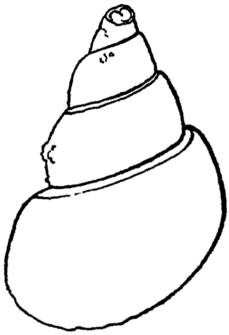

Fig. 9

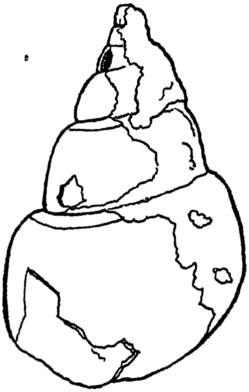

Fig. 10

Figs. 1, 2. *Vivipara grangeri*, new species. Enlarged ×2. Holotype. Catalogue G. S. C. 3000.

Fig. 3. *Vivipara grangeri*. Mutation α. Enlarged ×2. Catalogue G. S. C. 3001.

Fig. 4. *Vivipara grangeri*. Mutation α. Enlarged ×2. Catalogue G. S. C. 3002.

Fig. 5. *Vivipara grangeri*. Mutation β. Enlarged ×2. Catalogue G. S. C. 3003.

Fig. 6. *Vivipara grangeri*. Mutation β. Enlarged ×2. Catalogue G. S. C. 3004.

Fig. 7. *Vivipara grangeri*. Mutation β. Enlarged ×2. Catalogue G. S. C. 3005.

Fig. 8. *Vivipara grangeri*. Mutation β. Enlarged ×2. Catalogue G. S. C. 3006.

Fig. 9. *Vivipara grangeri*. Mutation β. Enlarged ×2. Catalogue G. S. C. 3007.

Fig. 10. *Vivipara grangeri*. Mutation θ. Enlarged ×2. Catalogue G. S. C. 3008.

nounced, particularly in the case of the last three whorls; the fifth and sixth (body) whorls, each with its uppermost margin along the suture, somewhat flattened or even depressed, forming an incipient sutural shelf with, more rarely, a slight canaliculation. All the whorls without angulations or edges on surface. Fine striæ are recognizable on the fourth whorl, and are particularly distinct on the surfaces of the last two. They are somewhat oblique and curved. Umbilicus small and shallow. Inner lip thin, its lower portion somewhat overshadowing the umbilicus. Aperture oval, large.

Length, excluding apex and part of first whorl, 25 mm.; width of body whorl 18 mm.

Apical angle not determinable; side angle, 49.2°.

A number of individuals of this species were collected and found associated with a duck-billed dinosaur. Many of the specimens are covered with sandy clay, and a few had adhering minute pieces of iron oxide. Most of them have the apex and part of the first whorl broken off.

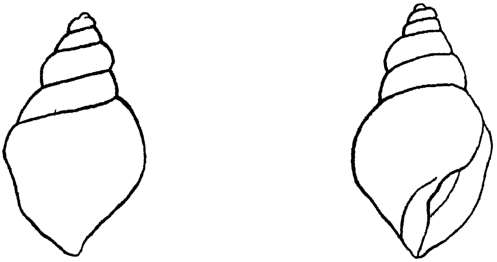

Fig 11 Fig. 12

Figs. 11, 12. *Vivipara fusistoma*, new species. Enlarged ×2. Holotype. Catalogue G. S. C. 3009.

In the series of specimens, many variations and changes in growth could be observed. The younger shell, whose length measures 14–16.5 mm. and body whorl 9–12 mm. wide, has the sutural shelf not yet developed. The surfaces of all the whorls of the spire are moderately convex without any tendency to be flattened or depressed along the suture. The body whorl shows a gentle sloping from the suture in spite of its considerably more convex surface. The suture between the body whorl and the last whorl of the spire is almost the same as, or only slightly deeper than, the one between each two whorls of the spire. The shell at this stage of growth (Figs. 3 and 4) is designated as mutation α (in Waagenian sense). Coming to an older stage we can recognize at once the gradual development of the sutural shelf. The suture between the body whorl and the preceding one becomes more pronounced, owing to the slight raising of the region along the uppermost margin of the body whorl. In the region near the aperture, the sutural shelf begins to appear, but it is not conspicuous (Figs. 5 and 6). The larger shells have this sutural shelf clearly marked out along the uppermost margin of the body, and the sutures bounding the uppermost margin of the last whorls of the spire are decidedly pronounced (Figs. 7, 8 and 9). The sizes of the shells run from 15 mm. to 22 mm. long and from 12.5 mm. to 14.5 mm. wide in body whorl. The shell at this stage is designated mutation β. Finally, the development of the sutural shelf could be seen not only along the uppermost margin of the body whorl but also along that of the last whorl of the spire, and the tendency to grow such a characteristic structure is even traceable in the preceding whorl on the spire in the case of a still larger shell (Fig. 10) which measures about 25 mm. long and about 18 mm. wide in its body whorl. This is designated as mutation θ. These stages are quite traceable in the large number of specimens in the present collection and are shown particularly in these few whorls, whose sutures and whorl surfaces are not obscured with sandy clay.

HORIZON AND LOCALITY.—From the gray sandy clay layer of the Dohoin Usu formation (Cretaceous), 55 miles east and 60 miles north of Shabarakh Usu, Outer Mongolia. Collected by Mr. Walter Granger, Central Asiatic Expedition, 1925.

HOLOTYPE.— Museum of the Geological Survey of China, Catalogue No. 3000.

Specimens of mutations figured (Figs. 3–10). Museum of The Geological Survey of China, Catalogue Nos. 3001, 3002 (Figs. 3, 4, mut. α); 3003–3007 (Figs. 5–9, mut. β); 3008 (Fig. 10, mut. θ).

Vivipara fusistoma, new species

Text-Figs. 11, 12

Shell of comparatively small size, fusi-ovoid, moderate-spired. Whorls 5. Apex not preserved in the type specimen. First whorl slightly shorter than second. Second whorl only one-half the third in length. First two whorls slightly convex. Third whorl very convex, more so than fourth. Fourth whorl not exceeding, or practically equal to, third in length. Surface of fourth whorl convex only to a moderate degree. Body whorl much larger, its length greater than that of the spire, but not so expanded laterally as in the case of the preceding species; its surface very convex. Suture between whorls distinct, perhaps shallow between the first two whorls. Aperture fusiform in outline. Peristome seeming to be reflected, both outer and inner lips appearing to be comparatively thick. Umbilicus not clearly shown in the preservation.

This specimen was covered all over with hardened sandy clay. After it had been cleaned, it was not possible to make out the striæ on the surfaces of the whorls, but it appears to have very fine striæ on the last two whorls. The body whorl has a moderate blunt shoulder in its last half portion. Only one specimen of this species is found in the collection.

Length, excluding apex, 17.3 mm.; width of body whorl, 10.7 mm.

Apical angle not determinable; side angle, 37°.

HORIZON AND LOCALITY.—Same as the preceding species. Collected by Mr. Walter Granger.

TYPE.—Museum of The Geological Survey of China, Catalogue No. 3009.

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59.82 (728.1)

STUDIES FROM THE DWIGHT COLLECTION OF GUATEMALA BIRDS. III

By Ludlow Griscom

This is the third[1] and final paper containing descriptions of new forms in the Dwight Collection, or revisions of Central American birds based primarily on material in The American Museum of Natural History. I have been, however, greatly aided throughout the progress of my work on this collection, by having the free use of the collections of the Museum of Comparative Zoölogy.

I am greatly indebted also to Messrs. Dickey and Van Rossem for the loan of material and notes from their Salvador collection which is unique. With unexceeded generosity they have urged me to publish and use information which they themselves have discovered, and which was undoubtedly in manuscript form in their final report. I have never had a more interesting or more profitable correspondence. In one case beyond, I describe a Salvador oriole based on specimens received by the Museum of Comparative Zoölogy in exchange. With the warm approval of the Bird Department, the type has been returned to Mr. Dickey's collection, and is consequently cited by his original catalogue number, and as being in his collection.

As usual, all measurements are in millimeters, and technical color-terms follow Ridgway's nomenclature. The identification of the specimens in the Dwight Collection is now completed, and by the time this paper is published, it will be available in New York.

Cryptoglaux rostrata, new species

Type.—Dwight Collection, Amer. Mus. Nat. Hist.; ♀ "slightly immature"; Sacapulas, Rio Negro Valley, Central Guatemala; March 5, 1928; A. W. Anthony.

Specific Characters.—Toes bare for last joint; wings and tail unspotted with white, as in *C. ridgwayi* Alfaro of Costa Rica; forehead white as in *acadica* (Gmelin) of North America, but without the border of vertical white streaks; the rim of the facial disk also devoid of the white streaks, present in *acadica;* bill twice as large as in the other two species (all dimensions considered), the length of exposed culmen, 20 mm.

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[1] Amer. Mus. Novit., No. 379, 1929, and No. 414, 1930.

This very interesting find of Mr. Anthony's raises some absorbing questions. In the first place, it dispels our illusion that saw-whet owls in Central America are boreal birds found only in high mountains. The type of *rostrata* was taken in the Arid Tropical Zone at 4500 ft. In the next place, the suspicion is aroused that *Cryptoglaux* and *Gisella* are scarcely separable genera (see Ridgway, Bull. 50, U. S. Nat. Mus., part 6, 1914, p. 619, footnote), and that tropical saw-whet owls never acquire the so-called adult plumage. It will be recalled that Salvin found a *Cryptoglaux* in 1873, in a museum in Guatemala, which was also in the "immature" plumage.

The comparative characters of the three saw-whet owls are best shown in tabular form as follows.

	acadica	*rostrata*	*ridgwayi*
Toes	Fully Feathered	Partly bare	Naked, except base of outer
Wing	Longer and more pointed	Shorter and rounded	Shorter and rounded
Bill	Small and delicate	Large and heavy	Small and delicate
Culmen	Maximum, 14 mm.	20 mm.	13 mm.
Wings	Spotted with white	No white	No white
Tail	Barred with white	No white	No white
Forehead	White	White	Buffy brown
Suborbital Region	Sooty black	Dark brown	Buffy brown
Under Wing-coverts	White	Wood brown	Wood brown

Cardellina rubrifrons bella, new subspecies

TYPE.—No. 60472, Dwight Collection; ♂ ad.; Chichicastenango, Guatemala; January 27, 1925; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Similar to typical *Cardellina rubrifrons* (Giraud) of southern Arizona and Mexico, but general coloration darker and clearer; red areas slightly darker, approaching crimson, most conspicuous on forehead; gray of upperparts darker and slatier; underparts grayer, less white, the chest, sides, and flanks more extensively washed with gray of a darker shade and less tinged with pink.

MATERIAL EXAMINED

Cardellina rubrifrons rubrifrons.—Large series from Mexico and southern Arizona.

Cardellina rubrifrons bella.—Guatemala: Chichicastenango, 2 ♂, 1 ♀.

The slightly darker coloration is quite obvious in the Guatemalan birds, and is sufficient to characterize a southern subspecies.

SMARAGDOLANIUS, new genus

GENERIC CHARACTERS.—Similar to *Vireolanius* Du Bus, but tail two-thirds length of wing or less; outer toe coherent to middle toe for two basal phalanges; rictal bristles inconspicuous, the longest scarcely exceeding the bristly points of the frontal feathers; bill relatively longer and narrower; coloration chiefly bright green and yellow.

TYPE.—*Vireolanius pulchellus* Sclater and Salvin.

The type of the genus *Vireolanius* is *melitophrys* Bonaparte, one of the rarest of Central American birds in collections, characteristic of the oak forests of the Temperate Zone on the high mountains of southern Mexico and western Guatemala. This bird is in coloration and structure, quite different from the three species *pulchellus*, *eximius*, and *leucotis*, which are much better-known birds of tropical rain forests from southern Mexico to Amazonia, and which have always been incorrectly referred to *Vireolanius*. So much is this the case that the only recent technical diagnosis of *Vireolanius* (that of Ridgway) is based on *pulchellus* and not *melitophrys!* It is, therefore, the latter which really needs to be described, although it is the type of the genus. The contrasted diagnosis of *Vireolanius*, as here construed, follows.

Vireolanius.—Tail more than five-sixths length of wing; outer toe almost or entirely free from middle toe; rictal bristles well developed, the longest over 1 cm. in length; bill relatively much shorter and wider; coloration very variegated and bizarre.

Three fresh specimens of *Vireolanius* collected by Anthony have the feet in excellent condition, and show the great development of the rictal bristles which have not been broken off or worn with age.

Some years ago, Dr. Wetmore gave a paper at an A. O. U. meeting in which he showed, I believe, that these birds and *Cyclarhis* were not vireos. His final conclusions have not been published as yet, and the matter may well be left alone until they are. With ample field experience with *Cyclarhis* (every Central American form), it is incredible that this genus is vireonine, and the same is probably true of *Vireolanius*. In life, *Smaragdolanius* at least resembles other vireos in haunts and habits, but its song is a loud sweet whistle of two syllables, suggesting the call note of a pine grosbeak or lesser yellowlegs.

Vireo huttoni vulcani, new subspecies

TYPE.—No. 56442, Dwight Coll.; ♂ ad.; Quetzaltenango (8500 ft.), Guatemala; November 22, 1919; Austin Paul Smith.

SUBSPECIFIC CHARACTERS.—Similar to *Vireo huttoni mexicanus* Ridgway of Puebla, Mexico, but olive-green above with a slight brownish tinge, entirely lacking the dull gray tint on the pileum and back, the rump scarcely brighter than the rest of the upperparts; underparts in breeding adults radically different from any other race in being almost uniform pale dirty yellowish-olive, quite different from the brownish-buff wash characteristic of young *mexicanus;* resembles *mexicanus* in larger size and in having the throat and abdomen scarcely lighter than chest.

MATERIAL EXAMINED

Vireo huttoni mexicanus.—Mexico: Vera Cruz, 1 ♀; southern Tamaulipas, 4 ♂, 4 ♀.

Vireo huttoni vulcani.—Guatemala: Momostenango, 1 ♂, 1 ♀; Chichicastenango, 1 ♂; Tecpam, 3 ♂, 2 ♀ (breeding adults); Zanjon, 1 ♂, 1 ?; Quetzaltenango, 6 ♂, 3 ♀.

Also adequate series of all the other described forms.

There was only one record for Hutton's vireo in Guatemala, and it was supposed to be a winter visitant. Messrs. Smith and Anthony deserve the credit for rediscovering this species in Guatemala, and proving that it is a fairly common resident in the Temperate Zone (about 8000 ft.) of the great volcanoes of western Guatemala. It is by no means surprising to find that it is a very distinct subspecies, which requires no further comment. Some years ago when Smith's original series came in, Dr. Dwight and I compared them with a good series of *mexicanus,* in The American Museum of Natural History, and were positive the bird was undescribed. Additional material merely strengthens this impression.

Catharus mexicanus cantator, new subspecies

TYPE.—No. 60329, Dwight Coll.; ♂ ad.; Finca Sepacuite (3500 ft.), about 50 miles east of Coban, Vera Paz, Guatemala; May 26, 1925; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Similar to typical *Catharus mexicanus* (Bonaparte) of Vera Cruz, Mexico, but generally darker in color; upperparts with a bister-brown tint to the olive; chest, sides and flanks darker olive; decidedly smaller, as in the Costa Rican *fumosus;* wing of males 84.5–92, average 86.7.

MATERIAL EXAMINED

Catharus mexicanus mexicanus.—Mexico: Vera Cruz, 3 ♂; southern Tamaulipas, 20 ♂, 2 ♀.

Catharus mexicanus cantator.—Guatemala: Finca Sepacuite, 3 ♂, 1 ♀; Barillos, 1 ♂.

Catharus mexicanus fumosus.—Costa Rica and western Panama, large series.

Formerly regarded as a rare bird, this *Catharus* is now becoming well represented in collections, and a study of its variation is feasible. Large series show that *smithi* Nelson from southern Tamaulipas is inseparable from true *mexicanus,* which may be characterized as a large, medium-olive form. The new race *cantator* is a small, darker, browner-olive form. The Costa Rican *fumosus* is also small and dark, but the chest, sides, and flanks average more slaty, less brownish olive. Needless to say, true *mexicanus* does not occur in Costa Rica.

Variations of age and sex are just as important as racial variation. In the first place, females are more olive below than males, the cap is not so jet-black, the forehead at least is olive-brown, and sometimes the whole pileum is faintly margined with this color. Older males are also undoubtedly more slaty, less olive than younger males, and only old males have an all yellow bill. It will be apparent, therefore, that females of *fumosus* will very closely resemble young males from Mexico or Guatemala. A final point of difficulty is post-mortem change. Old skins are browner, less gray, a fact which has also confused the issue in the past.

In The American Museum of Natural History there are large series from northern Nicaragua southward. Fifteen specimens from Nicaraguan localities are intermediate between *cantator* and *fumosus* and should be recompared with recent material from farther north. Specimens from as far south and east as Veraguas are not separable from Costa Rican material.

Turdus grayi umbrinus, new subspecies

TYPE.—No. 58125, Dwight Coll.; ♀ ad.; Finca El Cipres (2300 ft.), near Mazatenango, Pacific slope, Guatemala; July 25, 1924; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Nearest to typical *Turdus grayi* Bonaparte of eastern Guatemala, but darker and more richly colored, much browner, less olive above, bright Isabella brown rather than clay color or brownish buff below, in any plumage most conspicuous on the belly and under tail-coverts; worn specimens are very close to fresh specimens of *grayi*, but radically different from *grayi* in comparable plumage. Differing from all other races in even greater degree than from *grayi*.

MATERIAL EXAMINED

Turdus grayi grayi.—Mexico: Vera Cruz, 20; Oaxaca, 6; Quintana Roo, 2. British Honduras, 3. Eastern Guatemala (13 localities), 37. Eastern Honduras, 15.

Turdus grayi umbrinus.—Guatemala (Pacific slope): 30 specimens from Ocos to San José.

A few years ago (Amer. Mus. Novit., No. 183, 1925, pp. 3–4) Miller and I gave a brief review of the races of this robin. The Dwight Collection and the much more extensive material in the Museum of Comparative Zoölogy, when combined, tend to confirm the general conclusions then advanced, but permit a better precision as to the ranges of the various forms and the degree of individual variation in size and color

As there are obviously two races in Guatemala, the first thing to do is to decide just what *Turdus grayi* Bonaparte is. The name is based on a bird brought back by Colonel Velasquez de Leon, as part of a small collection acquired during a two weeks visit to Guatemala. Dearborn has suggested (Field Mus. Publ. 125, 1907, p. 136) that the type probably came from the Pacific coast region, as several of the species reported in the paper are restricted to that region. A careful examination of the paper shows, however, that other species reported could have come only from the highlands, and others are restricted to the Caribbean rain forest (for instance, *Pachysylvia decurtata*). It is apparent, therefore, that Colonel Velasquez must have bought a collection of the trade-skins of the day, in addition to whatever he shot himself. The type may have come from any part of Guatemala. Post-mortem color-change in this species is so pronounced that specimens taken prior to 1900 are usually worthless for subspecific comparison. It consequently makes little or no difference whether the type still exists or not. For many years, trade-skins from "Guatemala" and good series from Vera Cruz have been passing as typical *grayi*. Modern series from Alta Vera Paz and Vera Cruz are identical. I, therefore, designate Alta Vera Paz as the type-locality, thereby avoiding any changes in nomenclature.

Large series show great seasonal and individual variation. Worn specimens of *grayi* are much paler below and have been confused with *tamaulipensis*. Birds in very fresh plumage (chiefly October to December) are much more richly colored below. The size variation in all good series from one locality is about 10 mm. in the wing of males. Series from the highlands on the eastern side of the Pacific Cordilleras of Guatemala average 1.3 mm. larger than series from Vera Paz and Vera Cruz.

The new form from the Pacific lowlands is the brownest and most richly colored extreme of the species.

Myadestes unicolor veraepacis, new subspecies

TYPE.—No. 60281, Dwight coll.; ♂ ad.; Finca Sepacuite (3500 ft.), 50 miles east of Coban, Alta Vera Paz, Guatemala; May 4, 1925; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Nearest to *Myadestes unicolor pallens* Miller and Griscom of northern Nicaragua in being a paler and purer gray than typical *unicolor* of Vera Cruz, but intermediate in not being quite so light on the belly; chest distinctly darker than chin, throat and belly; eye-ring almost complete; a hoary spot on gape just below black of lores; chest feathers without light shaft-streaks; outer rectrices clear gray, not brownish gray; size as in *unicolor*; wing, 100 mm.; tail, 92 mm.

MATERIAL EXAMINED

Myadestes unicolor unicolor.—Vera Cruz, 3.
Myadestes unicolor veraepacis.—Alta Vera Paz, the type.
Myadestes unicolor pallens.—Northern Nicaragua, 12.

A very distinct form, though intermediate in that it has the paler color of *pallens* and the size of *unicolor*. The contrasted color below, the pure gray outer rectrices, the distinct eye-ring and the hoary spot below the lores are, however, characters which separate it almost at a glance. It is isolated in the highlands of Vera Paz, and there is a big "break" in the range, before the species reappears in northern Honduras.

Cinclus mexicanus anthonyi, new subspecies

Type.—No. 63484, Dwight coll.; ♂ ad.; San Mateo (8250 ft.), 45 miles east of Nenton, western Guatemala; February 12, 1927; A. W. Anthony.

Subspecific Characters.—Similar to *Cinclus m. mexicanus* Swainson of Mexico, but a purer, less brownish gray throughout, especially on the underparts; head even darker sepia, the area more restricted on the nape, and much more sharply demarcated from the gray body-color both above and below.

Material Examined

Cinclus mexicanus mexicanus.—Mexico: Vera Cruz, 2; southern Chihuahua, 17.

Cinclus mexicanus anthonyi.—Guatemala: San Mateo, 3 ♂; 2 ♀; Barrillos, 1 ♂; Tecpam, 1 ♀.

This very distinct form is easily separable by the cleaner, purer gray, and the sharper definition of the brown head. No comparison is needed with the North American race. The occurrence of a dipper in Guatemala rests on a sight record of Salvin's, who shot one of a pair in a mountain torrent above Totonicapam, but lost it in the stream. It is, therefore, quite appropriate to name this local race after the only man who ever succeeded in collecting a series.

Sporophila morelleti mutanda, new subspecies

Type.—No. 63845, Dwight Coll.; ♂ ad.; Hacienda California, near Ocos, Pacific slope, western Guatemala; June 9, 1926; A. W. Anthony.

Subspecific Characters.—Adult male very different from typical *S. morelleti* (Bonaparte) of eastern Guatemala, and scarcely separable from adult males of the whiter phases of *S. aurita*; differing from the latter only in the presence of minute white spots on the wing-coverts; differing from typical *morelleti* in having the chin and throat largely black, connected with the pectoral collar, which is twice as broad; white on ear-coverts, sides of neck, rump and wing-coverts, greatly reduced; females inseparable from typical *morelleti*, and in no way suggesting *aurita*.

Material Examined

Sporophila morelleti morelleti.—Large series from entire range.

Sporophila morelleti mutanda.—Thirty-five specimens from the Pacific coastal plain of Guatemala.

The adult males in the Salvin and Godman collection from western Guatemala, which Sharpe referred to *S. aurita*, thus giving that species a discontinuous distribution, undoubtedly belong to the bird here described, and true *aurita* does not range north of southwestern Costa Rica. Ornithologists have long been familiar with the complex permutations of characters in the black and white species of this genus in Central and northern South America, but the present case is surely unique in Central American birds. Anyone looking at the great series of skins in the Dwight Collection from eastern and western Guatemala can see at a glance that two very distinct forms are involved, but forms only, in spite of the fact that the males of one are practically inseparable from a distinct species farther south. In the first place, the females of the two forms are inseparable and quite different from the female of *S. aurita*. In the second place, obviously intermediate males occur in the highlands, which are geographically intermediate.

While every male specimen of the new form is instantly separable from typical *morelleti*, they are by no means constant among themselves. The amount of white on the throat is variable, and in some cases a white area separates the black of the chin from the black of the pectoral collar. There is also variation in the amount of white on the wing-coverts and rump. In other words, males of *mutanda* are to a lesser extent polymorphic, like the males of *S. aurita*.

As a matter of fact, there are other male *Sporophilæ* before me, from the Pacific coast of Guatemala, which are neither typical *morelleti* nor *mutanda*. A preliminary statement of their characters could be made by saying that they formed a partial connecting link between *morelleti* and *torqueola* of southwestern Mexico, of which *S. albitorquis* Sharpe, known from two Oaxaca specimens, is probably a dimorphism. The case is a very complicated one, of great biologic interest, but cannot be more fully discussed until ample material becomes available from southwestern Mexico.

Saltator grandis hesperis, new subspecies

TYPE.—No. 56541, Dwight Coll.; ♂ ad.; San José, Guatemala; January 24, 1920; Austin Paul Smith.

SUBSPECIFIC CHARACTERS.—Similar to typical *Saltator grandis* (Lichtenstein) of eastern Mexico and eastern Central America, but larger, slightly darker, more slaty above, obviously darker, more slaty, less buffy below, particularly on the chest and sides; superciliary stripe averaging narrower and not extending so far back of eye; wing of males, 100–108.5 (105), in *grandis* 94–102 (98.6).

MATERIAL EXAMINED

Saltator grandis grandis.—Eastern Mexico, 4 ♂, 2 (?). British Honduras, 3 ♂, 1 ♀. Eastern Guatemala, 1 ♀. Eastern Honduras, 1 ♂, 1 ♀. Eastern Costa Rica, 2, ♂ 3 ♀.

Saltator grandis hesperis.—Guatemala: Pacific coastal plain, 13 ♂, 12 ♀, from various localities, Ocos to San José; central highlands, San Lucas, 3 ♂; Panajachel, 1 imm.; Lake Amatitlan, 1 ♂, 1 ♀. Western Nicaragua, 1 ♂, 1 ♀.

We now know a great deal more about the range and variations of *Saltator grandis* than when Ridgway wrote in 1901. A paler form tending to be extensively whitish on the belly is now known as *yucatanensis* Berlepsch. In Salvin's day this species was unknown in eastern Guatemala, but was found there by Anthony, as was surely to be expected. Birds from the Pacific coast and highlands of Guatemala are readily separable as being larger and darker. A specimen from Finca La Primavera, at 3500 ft. in Baja Vera Paz, is intermediate, resembling *hesperis* in size but *grandis* in color. A specimen from Finca Chama in the tropical lowlands is typical *grandis*. As we go southward there seems little change as far as Nicaragua. Specimens from Costa Rica are, however, a little darker in color, but run as small as the smallest Mexican and British Honduras specimens, perhaps even less. These characters are perhaps too tenuous for a fourth form.

Aimophila ruficauda connectens, new subspecies

TYPE.—No. 58485, Dwight Coll.; ♂ ad.; Progreso, Guatemala; July 8, 1924; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Intermediate between typical *ruficauda* (Bonaparte) of Nicaragua and Costa Rica and *Aimophila ruficauda lawrencii;* upperparts grayer, less rufescent, nearer *lawrencii* in this respect; tail rufescent as in *ruficauda*, not brown as in *lawrencii*.

MATERIAL EXAMINED

Aimophila ruficauda ruficauda.—Nicaragua, 2. Costa Rica, 7 ♂, 9 ♀.

Aimophila ruficauda connectens.—Guatemala: Progreso, 19 ♂, 8 ♀, 6 imm.; Gualan, 1 ♂ (M. C. Z.).

Aimophila ruficauda lawrencii.—Mexico: Oaxaca, 8 ♂, 10 ♀.

This form is isolated in the arid Motagua River Valley and, while intermediate in characters, is easily distinguishable from the two extremes.

Aimophila rufescens gigas, new subspecies

TYPE.—No. 62955, Dwight Coll.; ♂ ad.; Nebaj, 50 miles north of Quiché, alt. about 6700 ft., Guatemala; April 29, 1927; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Similar to typical *Aimophila rufescens* (Swainson) of southern Mexico, but very much larger, and paler above, grayer on the hind-neck, the back a paler, less rusty brown; sides, flanks, and vent averaging grayer, less washed with buffish or brownish.

Material Examined

Aimophila rufescens rufescens.—Large series from Vera Cruz and Vera Paz, Guatemala; Salvador, 6 specimens from Chalatenango and San Salvador. Nicaragua: 11 specimens from the northern highlands.

Aimophila rufescens approaching *gigas.*—Guatemala: Sacapulas, 1 ♂, 1 ♀; La Perla, 2 ♂, 1 ♀.

Aimophila rufescens gigas.—Guatemala: Momostenango, 4 ♂, 1 ♀; Chichicastenango, 5 ♂, 1 ♀; Nebaj, 2 ♂; Antigua, 4 ♂, 1 ♀; La Montanita, 1 ♂; San Lucas, 11 ♂, 1 ♀; Panajachel, 4 ♂, 3 ♀, 9 imm.; Lake Amatitlan, 3 ♂.

Thanks to the courtesy of Messrs. Dickey and Van Rossem, I have before me six specimens of apparently typical *rufescens* from various points in Salvador, and four specimens of their very distinct *pectoralis*, apparently isolated on the Volcan San Miguel, which requires no further comment. There is nothing surprising in the distinctness of the bird of the Pacific highlands of Guatemala, but it is surprising that the sparrow farther south in the same mountain system should be inseparable from true *rufescens*. Nicaraguan birds are also inseparable from *rufescens*. Typical *rufescens* is really an intermediate between two extremes, the large pale *gigas* to the west, and the very small, dark *discolor* Ridgway in the lowland pinelands of the Caribbean slope from Peten to southern Honduras. As regards *rufescens* in Salvador and Nicaragua, I can only conclude that it was derived from the east rather than the north.

Wing of Adult Males

rufescens (Mexico)	—67–74.5	(series)
rufescens (Vera Paz)	—67–75	(series)
rufescens (Salvador)	— ?–74.5	(2 only)
rufescens (Nicaragua)	—68–75.5	(series)
gigas (West Guatemala)	—76–82	(series)
pectoralis (Salvador)	—77.5–78	(2 only)

Central American Races of *Zonotrichia* (*Brachyspiza*) *capensis*

For many years all Chingolo sparrows from Peru northward have been called *peruviana* (Lesson) for lack of proper material from the enormously diversified and extensive area involved. For two decades Dr. Chapman has been assembling a superb collection, and has long had it in mind to monograph the species. Many people are now aware that *peruviana* of authors is a composite of many subspecies, but the task of describing them should be left to the only person whose material is adequate. I therefore confine myself strictly to the two forms found in Central America, and compare them only with topotypes of *peruviana* from Lima, kindly forwarded by the authorities of The American Museum of Natural History.

In Central America this little *Zonotrichia* is strictly a highland bird, never occurring below 3000 ft. In parts of Costa Rica and Guatemala it has become a town bird, and its cheerful song can be heard from the roofs of houses in the heart of San José. In western Panama, however, it is quite local, as it prefers open rocky fields in the mountains, and this habitat is scarce in a heavily forested country. It is as yet unrecorded in eastern Panama, or between Guatemala and Costa Rica, but this probably signifies only lack of exploration. Years ago, J. A. Allen described the Costa Rican form without having seen topotypes of *peruviana*, which has a very restricted range in the arid littoral of Peru. Nevertheless, as might be expected, the Costa Rican bird is quite different from ANY Peruvian subspecies, and it will occasion students of Central American birds no surprise to learn that the representative in Guatemala is different again. Detailed comparative descriptions are appended below.

Zonotrichia capensis peruviana (Lesson)

TYPE LOCALITY.—Lima.

RANGE —Arid littoral of Peru. Specimens from southwest Peru (Ica and Arequipa) and northern Peru (Huancabamba) belong to other forms.

DIAGNOSIS.—A relatively large and pale subspecies; nuchal collar relatively pale rufous, sharply contrasted with back; back paler and more grayish brown, the streaking relatively distinct and narrow; auricular region much darker gray than superciliary stripe; sides and flanks washed with pale grayish brown.

MEASUREMENTS OF MALE.—Wing, 70–74 (72); culmen, 10.5–12 (11.2).

MATERIAL EXAMINED.—Six males, 4 females from Lima.

Zonotrichia capensis costaricensis J. A. Allen

TYPE LOCALITY.—San José, Costa Rica (cf. Bull. Amer. Mus. Nat. Hist., III, 1891, p. 375).

RANGE.—Highlands of Costa Rica and western Panama, east to central Veraguas.

DIAGNOSIS.—Distinctly darker and browner above, the brown with a vinaceous wash; nuchal collar rich rufous, sharply contrasted with back; black streaking very broad and heavy in fresh specimens; auricular region but little if any darker gray than superciliaries; sides and flanks heavily washed with buffy olive; decidedly smaller, but the bill as long.

MEASUREMENTS OF MALES.—Wing, 62–66 (64.5).

MATERIAL EXAMINED.—Costa Rica: good series including type. Western Panama: Boquete, 4 ♂.

Zonotrichia capensis septentrionalis, new subspecies

TYPE.—No. 60798, Dwight Coll.; ♂ ad.; Chichicastenango, Guatemala; January 27, 1925; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Nearest *Zonotrichia capensis costaricensis* Allen in general coloration, but black streaking above much less broad and heavy, as in *peruviana;* nuchal collar less sharply defined, the rufous tinge invading the interscapular area; decidedly larger.

MEASUREMENTS OF MALE.—Wing, 66.5–73 (70).

MATERIAL EXAMINED.—Guatemala: 84 specimens from 15 localities in the highlands.

Passerina versicolor purpurascens, new subspecies

TYPE.—No. 58453, Dwight Coll.; breeding ♂; Progreso, Guatemala; July 10, 1924; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Similar to typical *P. versicolor* (Bonaparte) of eastern Mexico, but much smaller; general coloration darker and duller; in adult male purplish-blue area on forecrown more restricted; wine-purple of hind-part of crown much duller, followed by a more distinct and more purplish nuchal collar; back darker and more purplish, less red; throat and chest much darker and duller wine-purple; immature male darker and grayer, less brown; wing, 63.5–66 (64.2), as compared with 68–71 (69.5) in the typical form.

MATERIAL EXAMINED

Passerina versicolor versicolor.—Thirteen specimens from southeastern Texas, Tamaulipas, Vera Cruz, and Jalisco (2). The latter slightly approach *pulchra* of Lower California in color.

Passerina versicolor purpurascens.—Guatemala: Progreso, 2 ♂ ad., 1 ♀ imm.

Even allowing for the worn condition of the Progreso birds, the new form is so different as to require no further comment. It is another interesting addition to the specialties of the arid Motagua Valley.

Pipilo maculatus repetens, new subspecies

TYPE.—No. 59,025, Dwight Coll.; ♂ ad.; Zanzon (alt. 8000 ft.) western Guatemala; January 8, 1925; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Strikingly different from typical *Pipilo maculatus* Swainson of the central and southern portions of the Mexican Plateau, the adult male much blacker above, the head not conspicuously darker than the back, only the rump and tail-coverts distinctly brownish olive, the back dark brownish with very inconspicuous diffused blackish streaks; white streaking of back much more developed; central tail feathers blackish, without obvious brownish-olive edges; averaging slightly larger, with a distinctly heavier bill; in general coloration approaching *montanus* Swarth of northern Mexico and the southern Rockies, but not so black above and with less white streaking and spotting on back and wings, the white almost never pure white, usually strongly tinted with brownish. Females differ in exactly the same respects; they are darker brown, the back more streaked with white.

MATERIAL EXAMINED

Pipilo maculatus maculatus.—Mexico: Hidalgo, 2 ♂; Puebla, 2 ♂; Oaxaca, 1 ♂, 1 ♀; Chiapas, 2 ♂, 2 ♀; "Mexico," 1 ♀.

Pipilo maculatus repetens.—Guatemala: 39 specimens from various localities in the Pacific Cordilleras.

Also large series of *montanus*, *megalonyx*, etc., from northern Mexico and the United States.

While individual birds are separable at a glance from true *maculatus*, it requires series to determine satisfactorily the respects in which birds from Guatemala differ from *montanus*. Midsummer specimens from Sierra Valparaiso, Zacatecas, and Alvarez, San Luis Potosi are intermediate between *maculatus* and *montanus* but apparently nearer the latter. However, good series might show differently. It must be remembered in making comparisons that worn specimens have less white edging on the wing, and the back tends to be more uniformly colored and to appear darker. Several specimens from Guatemala, sexed as males and taken in late summer and fall, are colored far more like females and are distinctly smaller. They are either erroneously sexed or perhaps younger males have these characters. They have been disregarded in the diagnosis and measurements.

I am greatly indebted to the Biological Survey for the loan of the series of true *maculatus* used.

WING OF ADULT MALES

Pipilo maculatus maculatus—83–87 (85.9).
Pipilo maculatus repetens —87–92 (89).

Icterus gularis troglodytes, new subspecies

TYPE.—No. 56504, Dwight Collection; ♂ ad.; San Felipe, Retalhuleu, Pacific slope of Guatemala; December 7, 1919; Austin Paul Smith.

SUBSPECIFIC CHARACTERS.—Exactly similar to typical *Icterus gularis* (Wagler) of Oaxaca, but one-third smaller in size; exceedingly close to *Icterus gularis tamaulipensis* Ridgway of eastern Mexico, but slightly larger, the yellow areas less orange-tinted, the black of the malar region not broader, and bill not proportionately deeper and stouter.

Icterus gularis gigas, new subspecies

TYPE.—Dwight Collection; ♂ ad.; Sacapulas, Rio Negro Valley, central Guatemala; February 4, 1928; A. W. Anthony; original No. 6513.

SUBSPECIFIC CHARACTERS.—Closest to typical *Icterus gularis* (Wagler), but averaging paler yellow throughout and of enormous size, one-third larger, nearly twice as big a bird as *troglodytes*.

Icterus gularis xerophilus, new subspecies

TYPE.—No. 58303, Dwight Coll.; ♂ ad.; Progreso, Motagua River Valley, central Guatemala; July 5, 1924; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Of the same gigantic size as *gigas*, but coloration rich cadmium-orange, as in *yucatanensis* Berlepsch.

MATERIAL EXAMINED

Icterus gularis gularis.—Mexico: Oaxaca, 10 ♂, 3 ♀; a specimen from Jalapa, Vera Cruz is nearer *tamaulipensis.*

Icterus gularis troglodytes.—Guatemala: Pacific slope, 29 from various localities, Ocos to San José; Antigua, 1 ♂; San Lucas, 1 ♂.

Icterus gularis gigas.—Guatemala: Sacapulas, Rio Negro Valley, 18.

Icterus gularis xerophilus.—Guatemala: Progreso, Motagua Valley, 21.

Icterus gularis tamaulipensis.—Eastern Mexico, 13. A specimen from Jalapa, Vera Cruz, approaches *gularis.*

Icterus gularis yucatanensis.—Yucatan, 8 specimens.

WINGS OF ADULT MALES

gularis	—125.5–131	(128)	
troglodytes	—116 -121	(118 5)	
gigas	—132 -138	(134.4)	
xerophilus	—130 -136	(132.3)	
tamaulipensis	—112 -114	(113);	with deeper bill proportionately
yucatanensis	—111 -115	(113);	with deeper bill proportionately

The extraordinary local size-variations of this oriole are without parallel in Central American birds. It is a species of the Arid Tropical Zone, and in Guatemala occurs abundantly on the Pacific slope, and locally in the arid sections of the two river valleys in the interior. The giant interior races seem almost specifically distinct, when compared with the Yucatan or the Pacific slope races, which closely parallel extremes of *Icterus sclateri* in size and coloration. Indeed, the very deep bill of *gularis* is the only means of separating very worn or immature specimens of these two species. What is even more extraordinary is that wherever the two species occur together, *Icterus sclateri* affords an exact duplication of the subspecific variation of *gularis.* This will be brought out in detail below.

Returning, however, to the variations of *Icterus gularis,* the intermediate forms are all found on the periphery of the range of the species. Thus, I have not listed above four specimens from Gualan, in the eastern lowlands of Guatemala, and the species is known to occur locally in this area. These birds in size and color will have to be called *gularis,* but they are really intermediates between the large *xerophilus* of the upper Motagua Valley and the small orange *yucatanensis* far to the northeast.

South of Guatemala we run into further complications. Mr. Van Rossem has kindly forwarded me the measurements of his Salvador series. His males are: wing, 120–131; a clear majority of the larger specimens not from higher altitudes, and a clear majority of the smaller specimens not from near sea-level. These birds can scarcely be called *troglodytes*, as the measurements of that race are very uniform and based on a large series. Unfortunately, no series exists from Honduras. The species is recorded from there, and will doubtless be found locally in the central portions, where large areas of suitable country occur. Such specimens will probably connect the large races of the interior of Guatemala with the Salvador birds. Certainly the specimens from the western Salvador lowlands, nearest Guatemala, Barra de Santiago, and Sonsonate, are among the smallest, and could easily be referred to *troglodytes*, while the majority of the birds from eastern Salvador and the interior are larger. What to call them may well be left to the discrimination of Messrs. Dickey and Van Rossem.

Icterus sclateri maximus, new subspecies

TYPE.—Dwight Coll.; ♂ ad.; Sacapulas, Rio Negro Valley, interior of Guatemala; February 12, 1928; A. W. Anthony; orignal No. 6563.

SUBSPECIFIC CHARACTERS.—Nearest *Icterus sclateri alticola* Miller and Griscom of Progreso, Guatemala, but much paler yellow throughout, gamboge or tinged with cadmium, never orange; resembling *alticola* and differing from all other forms in very large size and the almost solid black back.

Icterus sclateri connectens, new subspecies

TYPE.—No. 8250, collection of Donald R. Dickey, ♂ ad.; San Salvador (2100 ft.), Salvador; April 2, 1912; A. J. Van Rossem.

SUBSPECIFIC CHARACTERS.—Intermediate in size between the small typical *sclateri* Cassin of the Pacific lowlands of Nicaragua and the very large *alticola* Miller and Griscom of the interior of Guatemala; yellow as in *sclateri*, not orange as in *alticola;* more black, less yellow in back than *sclateri*, much less solid black than *alticola.*

Lack of material years ago caused Miller and me to make several erroneous assumptions in our description of *alticola* (Amer. Mus Novit., 1925, No. 184, p. 4), and Van Rossem made still others in his description of *pustuloides* (Condor, 1927, XXIX, p. 75). With fine series before me now from most of the range, it is only fair to all concerned to state that the true facts could not possibly have been deduced from the few specimens then available. I should like to make the following points:

1.—*Icterus gularis* (subgenus *Andriopsar* Cassin) differs structurally from *I. sclateri* in a relatively shorter and much deeper bill; adult males have long hairs scattered among the feathers of the nape, and twice as long as the feathers; the white tail-tips and wing-edgings are much narrower, a distinction which disappears in worn specimens.

2.—The Guatemala races of *Icterus sclateri* perfectly mimic the size and color characters of *I. gularis*, wherever the two birds occur together. The case is unique in Central American birds, but recalls the vasa parrots of Madagascar.

3.—*Icterus sclateri* is a much more local species than *I. gularis*. It does not occur in eastern Mexico or Yucatan, and is entirely absent from the Pacific coast of Guatemala. The characters of the Salvador race show that it came in from the east, and it has no relationship whatever to the subspecies in Oaxaca, which is entirely isolated.

4.—Van Rossem is entirely correct in stating that worn breeding specimens of *sclateri* have more black and less yellow in the back than fresh ones. He erred, however, in suspecting that the "black backed" *alticola* was based on worn material. As a matter of fact, the feathers of the back in this species are yellow or whitish at the base. In *alticola* and *maximus* the terminal half is black with or without a very narrow border and tip of yellow. In other races the black is reduced to a broad central shaft stripe, giving a streaked appearance (*sclateri*) or an oval, guttate spot, producing a spotted appearance (*formosus* of Oaxaca). Females in comparable plumage always have broader yellow edgings and tips than males, and average 8–9 mm. shorter in the wing. Immature birds have, first, olive-gray edgings, and later yellowish-olive edgings.

5.—Van Rossem states that *I. sclateri* is a summer resident only in Salvador, disappearing between October and March. This is a most interesting fact, and I could not dispute such competent field experience for a moment. On the other hand, published data and specimens before me show conclusively that the species is resident throughout the year in Mexico, Guatemala, and Costa Rica. A series from Oaxaca taken throughout the year shows that there is not the most minute difference between winter and breeding plumage, except for possible wear.

A synopsis of the known forms and their ranges follows.

Icterus sclateri sclateri Cassin, 1867

Type Locality.—"San Juan," Nicaragua.

Range.—Pacific slope lowlands of Nicaragua and northwest Costa Rica. In the interior of Nicaragua at higher altitudes, the characters of the subspecies break down rapidly and pass into *connectens* and *alticola*.

Diagnosis.—Size small; wing of males, 101–108, averaging 105; back yellow, with broad shaft streaks of black, the black and yellow in about even proportions in fresh males, the yellow predominating in fresh females, about even in worn females, black predominating in worn males; yellow of males a rich gamboge or cadmium; 18 specimens examined.

Icterus sclateri formosus Lawrence, 1872

Type Locality.—Juchitan, Oaxaca.

Range.—Oaxaca and Chiapas, south inland to extreme northern Guatemala (Chanquejelve), east of the Pacific Cordilleras.

DIAGNOSIS.—Size small; wing of males, 101–110.5; back yellow with broad, tear-shaped or guttate spots of black; in more than half the fresh males, the yellow predominating; otherwise, sequence of plumage as in the last form; general shade of yellow similar; Ridgway called attention to the probable validity of this race; 17 specimens.

Icterus sclateri connectens Griscom

TYPE LOCALITY.—San Salvador, Salvador.

RANGE.—Salvador and adjacent parts of Honduras. Specimens from the latter country and north central Nicaragua will probably prove to connect this subspecies with the large "black-backed" races of Guatemala.

DIAGNOSIS.—Size variable and intermediate; wing of males, 105–112.5; back of some fresh males with more black than worn specimens of the last two races; the average, intermediate between *alticola* and *sclateri*. It should be noted that Salvador specimens of this species show the same variability of size that *I. gularis* does; 6 specimens, plus Van Rossem's measurements and critique.

Icterus sclateri pustuloides Van Rossem, 1927

RANGE.—Localized, in the breeding season at least, on the slopes of the Volcan San Miguel, Salvador.

DIAGNOSIS.—Resembling *sclateri*, but yellow areas of adult males replaced by orange, orange-red, or flame-orange. Some years ago when Van Rossem was east, he showed me a series of topotypes of this well-marked subspecies.

Icterus sclateri alticola Miller and Griscom, 1925

TYPE LOCALITY.—Progreso, Guatemala.

RANGE.—Isolated in the western half of the arid section of the Rio Motagua Valley.

DIAGNOSIS.—Size large; wing of males, 110–116.5; back either solid black in fresh males, or with minute yellow edgings and tips; fresh females with less yellow than worn males of *sclateri* and *formosus*, about as in dark extremes of male *connectens;* yellow areas replaced by orange-yellow or orange; in both size and color characters exactly paralleling *Icterus gularis xerophilus;* 22 specimens.

It will be noted that *Icterus sclateri* in the 'British Museum Catalogue' is a reddish orange, black-backed bird, based on specimens from San Geronimo, near Salama, Guatemala, a locality near Progreso.

Icterus sclateri maximus Griscom

RANGE.—Localized around Sacapulas in the arid portion of the Rio Negro Valley in northwest central Guatemala.

DIAGNOSIS.—Resembling *alticola* in color and size, but yellow as in *sclateri*, etc., not orange; wing of males, 111–118; in size and color characters exactly paralleling *Icterus gularis gigas;* 17 specimens.

Icterus sclateri, subspecies

RANGE.—Confined to the extreme eastern end of the arid section of the Motagua River Valley, around Iguana and Gualan, Guatemala.

DIAGNOSIS.—Size very small; males, 101–104, female, 94; black about as in dark extremes of *connectens;* these variations exactly paralleling *Icterus gularis* in the same region.

I do not describe this form, as I have only three old trade-skins and one very worn female from Gualan.

Icterus pectoralis anthonyi, new subspecies

TYPE.—No. 58330, Dwight Coll.; ♂ ad.; Finca El Cipres, near Ocos, Pacific coast of Guatemala; July 28, 1924; A. W. Anthony.

SUBSPECIFIC CHARACTERS.—Resembling typical *Icterus pectoralis* (Wagler) of Mexico in the flame-orange tint to head, neck, and auriculars, and the relatively less spotted chest, but much smaller; slightly larger than *espinachi* Ridgway of northwestern Costa Rica, which has a more heavily spotted chest and a yellow head and neck, at most rich cadmium.

MATERIAL EXAMINED

Icterus pectoralis pectoralis.—Mexico: Oaxaca, 3 ♂. Guatemala: various localities east of the Pacific Cordilleras, 9 ♂, 1 ♀. Honduras: Copan, 1 ♂, 1 ♀. Nicaragua: 7 specimens from the north central highlands (Matagalpa and San Rafael del Norte). Wing of males, 107–115 (111).

Icterus pectoralis anthonyi.—Guatemala: various localities on the Pacific coastal plain, 24 ♂, 24 ♀. Nicaragua: 3 from Leon, Chinandega and Volcan Viejo, Pacific lowlands. Wing of males, 101–106 (103).

Icterus pectoralis espinachi.—Northwest Costa Rica, 8 ♂, 5 ♀. Wing of males, 95.5–104 (100).

I have suspected the existence of this well-marked intermediate race for some years, and, in fact, Miller and I characterized it fully in the MS. of our Nicaraguan report. At that time, however, we had only eighteen males available of all three forms combined, and preferred to see more material. Thanks to Mr. Anthony's zeal, the great series listed above amply confirms the characters of the three forms. It seems only fitting that one of the many interesting and novel orioles secured by Mr. Anthony should bear his name.

Wagler's description and measurements show that this type was a large bird. In the material listed above, it will be noted that several range extensions are involved. Salvador lowland material will doubtless prove to be *anthonyi*, but true *pectoralis* may perhaps occur in the mountains of the interior.

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NEW DOLICHOPIDÆ FROM CONNECTICUT

BY M. C. VAN DUZEE

Between June 6 and 28, 1929, Mr. C. H. Curran collected a large number of specimens of the family Dolichopidæ at Avon Old Farms, Avon, Conn. Through his kindness I have had the pleasure of working up the six species described here, collected by him at that time.

The types of these species are in The American Museum of Natural History, New York City.

Mesorhaga cærulea, new species

MALE.—Length, 3 mm. Face blue, opaque with white pollen when viewed from above, this pollen extending above the antennæ; front shining blue; palpi and proboscis yellow, the former with a large black bristle at tip; occiput green, with blue reflections and white pollen. Antennæ black; third joint rounded, not as long as wide, arista dorsal. Lateral and inferior orbital cilia white, those on the sides short, the lower ones long.

Thorax green with blue reflections, dorsum shining with a very little white pollen in front; pleura dulled with white pollen; scutellum and abdomen shining blue; hairs on abdomen black; hypopygium concealed, but with black lamellæ, extending downward; they are about as long as third joint of fore tarsi and two-thirds as wide.

All coxæ black, the anterior pair with long white hair; all femora black with a few white hairs below; broad tips of fore and middle femora, narrow tips of the hind ones, and all the tibiæ and tarsi yellow; tarsi a little darkened at tips; joints of fore tarsi as 33–14–10–6–7; of middle ones as 52–17–13–7–8; hind ones as 36–28–18–8–7. Calypters and halteres pale yellow, the former with brown border and white cilia.

Wings nearly hyaline; venation as usual in the genus.

TYPE.—One male, taken at Avon Old Farms, Avon, Connecticut, June 20, 1929.

Campsicnemus crassitibia, new species

MALE.—Length, 1.5 mm. Eyes almost touching on the middle of the face; face, front, palpi and proboscis black. Antennæ black, third joint a little longer than wide, triangular, pointed at tip, with arista inserted near its base.

Thorax and abdomen dark green; dorsum of thorax dull with brown pollen; abdomen short, depressed; hypopygium concealed.

All coxæ black; femora more or less blackened in the middle; middle and hind tibiæ yellowish, the tarsi largely brown; fore femora thickened basally, tapering to the tip; fore tibiæ thickened nearly equally throughout, except at the base, about as 32 long to 4 wide; fore tarsi with last joint flattened and a little widened; joints of fore tarsi as 14–6–5–4–5; of middle ones as 21–11–8–6–6; those of posterior pair as 11–18–12–9–7. Calypters and halteres yellow, the cilia of former black.

Wings grayish; third and fourth veins straight and parallel, the fourth ending just back of apex of wing; cross-vein at middle of wing; last section of fifth vein as 22, the cross-vein as 8.

Type.—One male, taken at Avon Old Farms, Avon, Connecticut, June 26, 1929.

This is a very small species. It has the hypopygium entirely concealed but seems to be a male. The fore femora and tibiæ are somewhat thickened and the last joint of fore tarsi slightly flattened and a little wider than the preceeding joints. Otherwise the legs and feet are plain.

Campsicnemus calcaratus Van Duzee

This species was described from Alaska in 1923 (Proc. U. S. National Museum, LXIII, p. 3). The name was preoccupied, having been used by Grimshaw in 1901 for a species from Hawaii; therefore, I propose the name **curvispina** for the Alaskan species.

Chrysotus atratus, new species

Male.—Length, 1.6 mm. Eyes contiguous; front very dark blue; palpi and proboscis black. Antennæ black; third joint wider than long, the tip quite deeply notched for the insertion of the arista.

Dorsum of thorax very dark green, appearing more black when viewed obliquely; pleura black. Abdomen depressed, very dark blue, a little more green posteriorly, its hair black; hypopygium concealed.

Coxæ, femora, tibiæ, tarsi, calypters, their cilia and the halteres black or brownish black; length of fore tibiæ as 26; joints of fore tarsi as 12–8–5–4–5; of middle tibiæ as 37, of their tarsi as 19–9–6–4–5; of hind tibiæ as 45, the joints of their tarsi as 13–10–6–5–4. Hind tibiæ with long, bristly hair.

Wings a little grayish; third and fourth veins bent backward a little toward their tips, but approaching each other a little because third vein is slightly more bent than fourth, the latter reaching the wing margin before the apex of wing; sections of fifth vein as 21–27, cross-vein as 7.

Type.—One male, taken at Avon Old Farms, Avon, Connecticut, June 16, 1929.

This would run to *bellus*, in the key to species in the Bulletin Buffalo Society of Natural Sciences, XIII, p. 8. It differs from that species in having the eyes contiguous and the halteres black.

Argyra fasciventris, new species

Male.—Length, 5 mm. Face about as wide as third antennal joint, silvery white; palpi yellow, white pollinose; proboscis brown; front opaque with white pollen. Third antennal joint more than twice as long as first two joints taken together; first joint with several bristles above; arista apical, two-thirds as long as third antennal joint; lateral and inferior orbital cilia white.

Dorsum of thorax and scutellum bright green with blue reflections; humeri white pollinose; pleura more black, white pollinose, the posterior edge yellow. First four abdominal segments yellow with narrow hind margins, the whole of last two segments black, the base of all segments with a narrow band of silvery white pollen, the bands on the second and third segments scarcely visible; hairs on abdomen black, with the exception of a few very short ones on the venter; hairs on sides of second segment few and very small; all bristles on the first segment black. Hypopygium shining black, formed about as in *cylindricus* Loew (Proc. U. S. Nat. Mus., LXVI, Pl. I, fig. 6), except that the outer lamellæ are straight and yellow: there are two large bristles about as long as the lamellæ, situated on the posterior surface of the hypopygium and about half as long as its height.

All the coxæ, femora and tibiæ yellow, the tips of posterior tibiæ a little brown; fore coxæ with a few minute yellow hairs and two slender black bristles; fore femora with a row of longer black hairs on upper posterior surface of apical half and below these scattering yellow hairs of about the same length on whole of apical half of posterior surface; middle and hind femora with only short hair; all tibiæ with rather slender bristles; fore tarsi with first two joints yellow, last three black; first joint a little enlarged at tip and with a row of little bristles below, which become longer apically; second joint a little swollen below and with several bristles at base, also with about eight little spines on middle half below, the last three joints with rather long hair; middle tarsi yellowish, somewhat blackened apically; hind tarsi wholly black; joints of fore tarsi as 46–18–13–14–8; of middle ones as 56–34–17–13–9; of posterior pair as 40–47–32–19–11.

Wings grayish; last section of fourth vein bent before its middle, parallel with third beyond the bend, ending in the apex of the wing; last section of fifth vein as 55, cross-vein as 25.

FEMALE.—Like the male in color and wing characters; face twice as wide as in the male; fore tarsi plain; third antennal joint as long as two basal joints, arista one-fourth longer than the antennæ.

TYPES.—Holotype, male, allotype, female, and one female paratype, taken at Avon Old Farms, June 18, 1929.

Dolichopus lobipennis, new species

MALE.—Length, 5 mm. Face moderately wide, yellowish white; front shining blue-green; antennæ black, the first joint yellowish with upper edge black; second joint yellow below; third joint about as long as wide, pointed at tip. Lateral and inferior orbital cilia white, about seven of the upper cilia on each side black.

Thorax and abdomen green with slight bronze reflections; dorsum of thorax with a little white pollen on the front part; hypopygium black, its lamellæ white with a black border (formed about as in figure 106, Bull. U. S. Nat. Mus., No. 116) somewhat triangular, with a petiole, and rounded at tip.

Fore coxæ wholly yellow, with small yellow hairs on anterior surface and black bristles at tip; middle and hind coxæ black; all the femora and tibiæ, most of the fore and middle tarsi and the first joint of hind tarsi yellow; middle tarsi infuscated toward the tip, the hind ones black from tip of first joint; all the femora nearly bare below, the middle and hind ones each with one rather small preapical bristle; middle tibiæ with one large bristle below; hind tibiæ with one large bristle on lower anterior surface and a row of stiff black hairs on the lower posterior edge of the apical two-thirds; middle basitarsi without a bristle; all tarsi plain; second joint of the hind tarsi a little shorter than the first. Calypters and halteres yellow; cilia of the former black.

Wings gray; last section of fourth vein a little bent near its basal third; third vein straight; costa with a knot-like enlargement at tip of first vein; anal angle of wing bilobed, the basal lobe extending toward the root of the wing, the one at the tip of sixth vein not very prominent.

TYPE.—One male, taken at Avon Old Farms, Avon, Connecticut, June 24, 1929.

This would run to *latronis* Van Duzee, in the table of species (Bull. U. S. Nat. Mus., No. 116, p. 24, group I, couplet 19). It differs from that species in having two distinct lobes at the base of wings and in other respects.

Hercostomus (Gymnopternus) currani, new species

MALE.—Length, 2.8–3.6 mm. Face and front opaque with white pollen, the former narrow below; antennæ wholy black, the third joint almost as long as wide, obtusely pointed at tip; orbital cilia wholly black.

Thorax and abdomen dark green, shining, with black hair and bristles. Hypopygium black, large, its lamellæ somewhat crescent-shaped, rounded apically, whitish in color with a blackish border, fringed with fine hair on the basal half and bristles on the apical half; inner appendages yellow, dark at tip, somewhat foot-shaped at the tip, with a long pale bristle on the side, about the length of the bristle from tip of the appendage; central organ yellowish brown, its tip sharply pointed, extending from the base of hypopygium but not reaching to its apex.

Coxæ yellow, the middle ones dark on outer surface of basal half; fore coxæ with a few small black hairs on anterior surface and black bristles at the tip; all the femora, tibiæ and the fore tarsi yellow, the latter sometimes a little brownish at tip; middle tarsi brown, the hind ones sharply black from tip of first joint, both sometimes black almost from base; fore tibiæ with the usual row of little bristles reaching nearly their whole length, the bristles of equal length, except that there are two longer ones among them; hind tibiæ with their tips slightly brownish on inner side; joints of fore tarsi as 22–12–9–6–7; of posterior pair as 28–30–23–12–10. Calypters and halteres yellow, the cilia of former appearing yellow in certain lights, black in others.

Wings uniformly tinged with blackish brown; third and fourth veins nearly straight and parallel, but the third vein a very little bent backward at tip; last section of fifth vein as 32, cross-vein as 21.

FEMALE.—Face wide, the face and front silvery white; color of thorax, abdomen, legs and feet as in the male; cilia of calypters black; form and color of wings as in the male.

TYPES.—Described from many males and females, all taken at Avon Old Farms, Avon, Connecticut, June 16–27, 1929. The holotype was taken on June 25, the allotype on June 24.

This form is near *humilis* Loew, but differs in having base of hind basitarsi distinctly yellow, usually yellow on more than basal half; hypopygial lamellæ with only a narrow blackish border, with delicate hairs on basal half and bristles on outer half of exterior edge. In *humilis* the lamellæ are broadly black on outer edge and fringed on whole outer edge with many bristly hairs.

This species was extremely common along the edges of the streams at Avon Old Farms. It was undoubtedly the most common insect in the region, and no especial effort was made to collect specimens, it being presumed that a species occurring in such numbers must be well known.

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59 7, 55 (51)

SOME CHINESE FRESH-WATER FISHES[1]

BY J. T. NICHOLS[2]

XXVI.—TWO NEW SPECIES OF *PSEUDOGOBIO*

Pseudogobio bicolor, new species

DESCRIPTION OF TYPE.—No. 9678, American Museum of Natural History, from Hokou, northeastern Kiangsi, collected June 22 to July 12, 1926, under the direction of Clifford H. Pope.

Length to base of caudal, 60 mm. Depth in this length, 5.4; head, 4.5. Eye in head, 3; snout, 2.6; interorbital, 4.5; maxillary, 3.4; width of mouth, 4; width of body, 1.5; depth of peduncle, 2.9; its length, 1.4; pectoral, 1; ventral, 1.4; longest dorsal ray, 1.1; longest anal ray, 1.6; caudal lobe, 1. Barbel in eye, 3.

Dorsal, 9; anal, 7. Scales, 36.

Body little compressed; lower surface of head and breast flattened, pectorals and ventrals in a horizontal plane; vent at one-third the distance from ventral axil to anal origin. Top of head flat, the orbital rims slightly raised; a depression in the profile between nostrils and end of snout; eye slightly superolateral; mouth small, inferior, curved; maxillary not reaching to below front margin of eye; lips free all round, striate or papillose, flaring at the sides; two enlarged broad flat papillæ at the chin, more than twice the length of those opposite on the upper lip which are slightly enlarged; maxillary barbel small and slender; gill-membranes rather broadly joined to shoulder-girdle under posterior margin of eye. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and anal axil; ventral placed under center of dorsal base; pectoral reaching almost or quite to ventral; ventral three-fifths to anal; caudal rather well forked, with pointed lobes. Lateral line complete, almost straight, rising to meet the opercle; breast scale-less backward to pectoral axils.

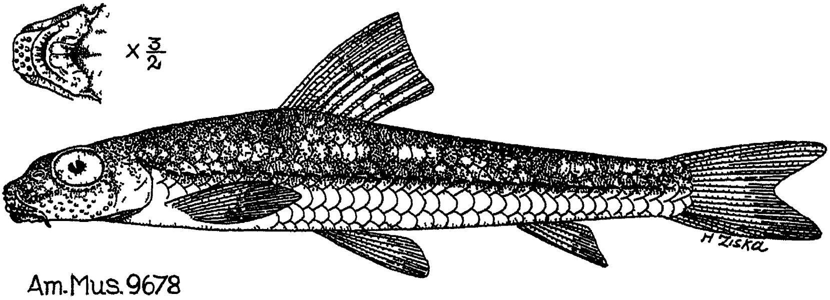

Fig. 1. *Pseudogobio bicolor*, type.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 104.

[2] Drawings of the type specimens by Mrs. Helen Ziska.

Sharply bicolor; dark above, pale below, the dark to just below lateral line and somewhat intensified in a poorly defined lateral band; dorsal and caudal grayish, former with slight indications of spots

Though based on a single specimen, this species seems to be quite distinct from other related small gudgeons examined and described by me. Strangely enough, another single specimen of *Pseudogobio* of 78 mm., from this same locality in Kiangsi, is unlike it and seems to be referable to *P. fukiensis,* described from Fukien province, as are four specimens 57 to 64 mm. long, from Kienning, Fukien. A larger series from Kienning, however, thirty specimens 45 to 142 mm. long, are not *P. fukiensis* and were at first confused with *P. labeoides* described from Hainan Island. A quite different lower lip (evenly papillose, with a cross furrow) distinguishes them from this last-named species which has a lip much as in *P. fukiensis* and *P. bicolor,* with two enlarged papillæ or smooth pads.

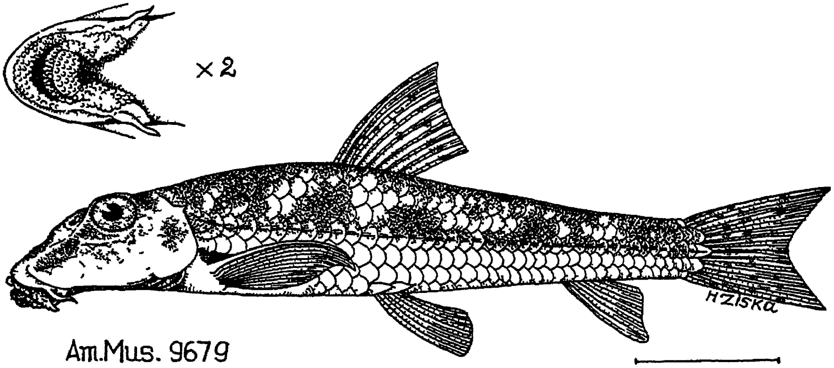

Fig. 2. *Pseudogobio papillabrus,* type.

Pseudogobio papillabrus, new species

Description of Type.—No. 9679, American Museum of Natural History, from Kienning, Fukien, collected August 1 to 8, 1926, by Clifford H. Pope.

Length to base of caudal, 119 mm. Depth in this length, 4.9; head, 3.5. Eye in head, 5; snout, 1.9; interorbital, 4.3; maxillary, 3.2; width of mouth, about 4; width of body, 1.6; depth of peduncle, 3.5, its length, 2.2; pectoral 1.3; ventral, 1.6; longest dorsal ray, 1.4; longest anal ray, 2; caudal lobe, 1.3. Barbel in eye, 1.5.

Dorsal, 9; anal, 8. Scales, 41.

Body not compressed, lower surface of head and breast flattened, ventrals in a horizontal plane and pectorals nearly so; vent close behind ventral axils, more than five times as distant from anal origin. Interorbital gently concave, the orbital rims raised; profile of snout slightly concave; eye somewhat superolateral; mouth small, inferior, curved, maxillary reaching about half-way to below front margin of eye;

lips expanded, papillose, flaring at the sides, free behind across chin, a cross furrow separating off the posterior part of the lower lip as a single broad papillose pad; maxillary barbel rather short, stout; gill-membranes rather broadly joined to shoulder-girdle under posterior margin of eye. Dorsal and anal without spinous rays; dorsal origin equidistant from end of snout and middle of peduncle; ventral origin about under center of dorsal base; pectorals somewhat falcate with curved tips, reaching six-sevenths the distance to ventrals, ventrals four-sevenths to anal; caudal shallowly forked, with pointed lobes; posterior margin of dorsal concave. Scales with well-marked, slightly radiating striæ; breast scale-less backward to pectoral axils; lateral line complete, straight.

A dark stripe downward and forward on the snout from eye, dark area on opercle, and dark mark above the pectoral base; six or seven dark blotches along the middle of side, and back irregularly spotted; the caudal with a few dark specks.

Measurements of the other specimens are given in the following table.

Standard Length	Depth in Length	Head	Eye in Head	Barbel in Eye
45 mm.	7.5	3.5	4.1	1.9
46	6.7	3.5	4.2	2
47	6.5	3.5	4	1.6
47	6.7	3.6	4.2	1.3
48	6.5	3.5	4.1	1.5
49	6.5	3.6	4 1	1.5
50	6.7	3.5	4 1	1.6
50	6.6	3.6	4.1	1.1
53	6.6	3.6	4	1.4
54	6.6	3.7	4.1	1.5
57	6.3	3.6	4.1	2
59	5.9	3.7	4	1.5
61	6.1	3.7	4 5	1.4
62	5.8	3.6	4	1.5
62	5.8	3.7	4.2	1.5
65	6.	3.6	4	1.4
66	6.5	3.6	4	1.4
66	6.5	3.5	4.1	1.5
69	6.4	3.5	4.5	1.5
69	5.5	3.6	4.3	1.6
69	6	3.7	4.1	1.6
69	5.5	3.7	4.2	1.6
70	5.7	3.6	4.5	1.5
70	5.9	3.6	4.2	1.6
72	6	3.7	4.5	1.7
73	5.4	3.7	4.6	1.5
77	5.5	3.6	5	1.6
111	5.6	3.8	5	1.5
142	5	3.8	5	1.7

The scale-count on the three largest specimens runs from 40 to 41. Several of the smaller specimens have a dark crescent indicated on the caudal like the type of *P. labeoides*.

XXVII.—A NEW CATFISH FROM NORTHEASTERN KIANGSI

Leiocassis (Dermocassis) analis, new species

Description of Type.—No. 9680, American Museum of Natural History, from Hokou, northeastern Kiangsi, collected June 22 to July 12, 1926, under the direction of Clifford H. Pope.

Length to base of caudal, 101 mm. Depth in this length, 5; head, 4.4. Eye in head, 7; snout, 2.8; interorbital, 2.9; maxillary, 2.7; width of mouth, 2.5; maxillary barbel, 2.5; width of head, 1.3; depth of peduncle, 2.8; its length, 1.5; dorsal spine, 1.6; pectoral spine, 1.6; longest dorsal ray, 1.3; pectoral, 1.5; ventral, 2; longest anal ray, 2.8; caudal, 1.4; length of adipose, 0.9; its height, 7.5; dorsal interspace, 1.

Dorsal, I,7; anal, 23½.

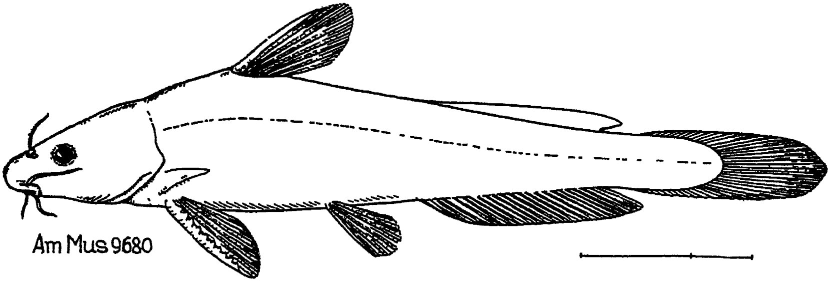

Fig. 3. *Leiocassis analis*, type.

Body moderately compressed; eye somewhat superolateral; interorbital flattish across the top, dropping to the eye at the sides; snout extending distinctly beyond the transverse, slightly curved, inferior mouth; with rather thick striate lips; orbital rim free, except imperfectly behind; top of head covered with thick skin; the backward process at the occiput about meeting that which extends forward from the dorsal plate; gill-membrances narrowly joined at base, free from isthmus; scapular process exposed, pointed, extending two-thirds the length of the pectoral spine. Dorsal spine rugose, striate, but without serration behind; pectoral spine smooth in front and barbed behind; pectoral reaching three-fifths the distance to ventral; ventral almost or quite to anal origin; adipose low, free behind; caudal narrow, rounded subacuminate, with keels on the peduncle above and below; dorsal origin slightly nearer anal origin than end of snout, its distance from end of snout about 2.2 in that from base of caudal.

Color in spirits, dusky; paler purplish gray below; unmarked.

This single specimen is sufficiently unlike considerable other material examined from China to leave no doubt as to its specific distinctness. As allied species are understood by the writer, its resemblances are with *L. tenuis*, than which it is deeper with a smaller eye, and with *L. ussuriensis*, than which it has a much longer anal.

The several allied catfishes of the subgenus *Dermocassis*, in China, may be differentiated as follows.

1. Caudal well forked; snout more or less elongate or swollen.
(*Nasocassis*) Nichols, 1925, equals (*Rhinobagrus*) Bleeker, 1865.
Caudal emarginate, truncate or rounded; snout not elongate or swollen. (*Dermocassis*) Nichols, 1925.................................2.
2. Caudal distinctly emarginate or notched. Dorsal spine without appreciable serration.................................3.
Caudal subtruncate to rounded.................................5.
3. Depth in length to base of caudal, 5 or less. Bases of vertical fins dark; distal portions of dorsal and caudal and center of anal slightly dusky.
medianalis (Regan) 1904. Yunnan.
Depth in length to base of caudal, 6 or more.................................4.
4. Anal rays, 19. The nasal barbel does not reach beyond and the maxillary barbel reaches somewhat beyond the orbit....*pratti* (Günther) 1892. Szechwan.
Anal rays, 16 to 18. The nasal barbel reaches posterior border of eye; the maxillary barbel reaches operculum. . *emarginatus* Regan, 1913. Szechwan.
Anal rays, 17. The nasal barbel reaches posterior border of eye; the maxillary barbel a little farther back............*similis* Nichols, 1926. Fukien.
5. [1]Dorsal spine low, about 2 in head.................................6.
Dorsal spine higher, less than 2 in head.................................7.
6. Peduncle more than twice as long as deep. A broad dark lateral band, at least posteriorly.......................*tæniatus* (Günther) 1873. Shanghai.
Peduncle less than twice as long as deep. No noticeable dark lateral band.
truncatus Regan, 1913. Szechwan.
7. Depth greater (5 in standard length at 100 mm.; 5.9 at 200 mm.). Eye smaller (7 in head at 100 mm.; 8.5 at 200 mm.)...........................8.
Depth less (6.6 in standard length at 132 mm.; 8 in length at 260 mm.). Eye larger (5.5 in head at 132 mm.; 7 at 260 mm.). Anal rays 20 to 22.
tenuis (Günther) 1873. Shanghai.
8. Anal rays about 23..........................*analis* Nichols, 1930. Kiangsi.
Anal rays about 18.................................9.
9. Mouth inferior transverse............*ussuriensis* (Dybowski) 1872. Ussuri R.
Upper jaw extending little beyond the lower.
taphrophilus (Sauvage and Dabry de Thiersant) 1874.

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[1] *L. albomarginatus* Rendahl, 1928, Anhwei, comes here. Caudal with a broad white margin; depth, 4.2 to 5: eye, 5.3 to 6.8 (at 49 to 90 mm. standard length).

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SOME GEOPHILOUS MEALY-BUGS FROM AUSTRALIA (HOMOPTERA: COCCOIDEA)

By T. D. A. Cockerell and Elmer D. Bueker

In 1894, *Ripersia maritima* Cockerell was described from specimens found on roots of the grass *Spartina* at Hempstead Harbor, Long Island. It occurred between tide-marks, being submerged at each high tide. It was remarked at the time that it showed a very close resemblance to *R. rumicis* Maskell, found among roots of *Rumex* in New Zealand. Since then, other related species have been described from California (*Ripersiella kelloggi* Ehrhorn and Cockerell) and the Rocky Mountains (*R. leucosoma* Cockerell); while the British *R. halophila* (Hardy), found on the roots of grass and other plants, proves to belong to the same group. This series of mealy-bugs is so distinctive in its characters, and the species are so similar, that it has been set aside as a distinct genus, *Ripersiella* Tinsley, 1899. It is, however, perhaps too close to *Rhizoecus* Künckel, 1878, which has five-jointed antennæ.[1] How does it happen that these coccids, the females of which can crawl only a short distance, are thus spread over the world? The species are different, and there is no reason to suppose that they have been spread by commerce. Are they representatives of a type of enormous antiquity, now surviving in certian localities? Other examples from other groups of coccids can readily be cited, suggesting some occasional mode of distribution no less efficient than the flight of Lepidoptera and Orthoptera. This, we cannot doubt, is transportation by migrating birds. Many of the shore birds, famous for their migrations, nest on the ground. It is comparatively easy for the newly-hatched larvæ of geophilous coccids to wander on to the body of a bird and be carried hundreds of miles in a single night. It is not to be supposed, nor does the evidence suggest, that this is constantly happening. It will suffice to explain the facts of distribution if it occurs at rare intervals, the larvæ still more rarely surviving the journey and finding a means of living at the other end. It is obvious that species thus transported will stand a good chance of survival if they are general feeders, or feed on grass. The specialized coccids with particular host-plants would stand hardly any chance.

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[1] Newstead gives a full account of *Rhizoecus terrestris* (Newstead), showing the peculiar antennæ.

The observed facts seem to agree well enough with these suppositions, and it will be interesting to determine how far geophilous or grass-feeding coccids are distributed in remote places or on islands. At the present time the records are quite inadequate. It is not so long ago that practically nothing was known of geophilous mealy-bugs in America, yet we now know that they abound in species and individuals, especially where the nests of the ant *Lasius* are to be found. From the southern hemisphere the records are few and scattered. Green is constantly adding species to the recorded fauna of the western Palæarctic region.

Mrs. Wilmatte P. Cockerell had long collected mealy-bugs under stones in New Mexico and Colorado, finding many new species. Consequently, when in Australia in 1928, she could not resist turning over likely looking stones, and was rewarded by the discovery of the two species now described. These must be referred to well-known genera of the northern hemisphere, as *Pseudococcus hystricosus* and *Trionymus angustus*. The genera of mealy-bugs have been defined in various ways, and are still subject to revision. Newstead (1903) used the following characters:

Adult females active, covered with mealy secretion, not enclosed in ovisac; female antennæ of eight joints....................*Dactylopius* (now *Pseudococcus*).
Adult females enclosed within ovisac at gestation;
antennæ of nine joints......................*Pseudococcus* (now *Phenacoccus*).
Antennæ of six (rarely five or seven) joints...........................*Ripersia.*

This appears simple, but the facts of nature are more complex, and the number of antennal joints differs in evidently related species. However, *Phenacoccus* has a denticle on the claw, which is a good diagnostic character. Ferris (1918) adopted a quite different scheme, stressing the importance of the cerarii, or groups of spines and pores, which range from none to twenty-four in different species. From these arise tufts or tassels of wax, so that, even when the cerarii have not been described, their existence can be inferred from the external appearance of the animals. The group with a denticle on the claw and the antennæ eight- or nine-jointed (usually nine) is divided into three genera: *Phenacoccus*, *Puto* (including *Ceroputo*), and *Heterococcus*. With these we are not now concerned. The other series is first separated into *Pseudococcus* (the common mealy-bugs), with more than four pairs of cerarii, and four other genera, with not more than four pairs. Here is perhaps a weak point, as the reduction of the cerarii has probably taken place independently in several series. Morrison (1925), tabulating a series of mealy-bugs, sets forth the true *Pseudococcus* (at least as relates to the six species included) as having at least one pair of cerarii present on the head between the antennæ. These cephalic cerarii are plainly visible in the Australian *Pseudococcus hystricosus* described below, but are wholly absent from *Trionymus angustus.* Morrison tabulates three species of *Trionymus* in the paper just cited; in *T. sacchari* (Cockerell), from sugar-cane, only the apical cerarian spines are present and these not well developed. In the new *T. danthoniæ* from Stewart Island and in *T. diminutus* (Leonardi) there are no cerarii on the head, but the former has two posterior pairs of cerarii, the latter three or four.

Trionymus, first described under the preoccupied name *Westwoodia,* was characterized by the elongated form of the body and eight-jointed antennæ. The shape of the body seems usually to be related to life on some narrow object, as a stem of grass, though *T. americanus* (Cockerell), which is very slender, occurs in cracks on the trunk of ash trees. The shape of the body and more numerous antennal joints appear to separate it from *Ripersia* but, as Ferris states, the definition and limitation of *Ripersia* are at present uncertain. There can be little doubt that the many species referred to this genus represent, at least in part, a mixture of generic types. The type of the genus (*R. corynephori* Signoret), a species with six-jointed antennæ, is not known to modern workers. The food-plant is a grass of southern Europe. It is probable that we may properly recognize, following current usage, a genus of geophilous mealy-bugs, mostly found with ants, resembling *Trionymus* in many respects, but with fewer antennal joints. But such species as *Ripersia fimbriatula* Cockerell and King will apparently have to be excluded, and it will be necessary to investigate anew the various aberrant species of "*Ripersia*" to determine what should be done with them.

New biological observations are needed. The reported food-plants may not always be correct. It is difficult, when a mealy-bug occurs on roots, or (as is commonly the case) on the under surface of stones, to determine exactly what plant is used for food. Experiments are needed to determine such points, and also to determine how long the newly hatched larvæ can survive without feeding.

The significance of variation in the number of antennal joints may not be the same in all cases. Coccid larvæ in general have six joints, and the number in mealy-bugs commonly increases with maturity. Thus, it may be expected that a species with a maximum of seven joints will show some individuals with six; or one with nine joints, some with eight. But to have only five joints in the adult (as in *Rhizoecus*) is more remarkable and represents a different tendency.

The specimens of *Pseudococcus hystricosus,* though well developed, are probably not mature, and it is probable that individuals with eight-segmented antennæ will be found. This is suggested by the presence of two whorls of hairs on joints two and three. But this is not conclusive at all, since some species with eight segments (as *Pseudococcus walkeri* Newstead) still show two whorls on each of these segments. The general character of the antennæ is much more like that of *Pseudococcus* than *Ripersia,* in spite of the six segments. The species is a very distinct one, remarkable for the densely glandular surface, coarse curved bristles of the antennæ, long beak, stout femora and long bristles at caudal end. Among the described Australian species it seems nearest to *Pseudococcus similans* (Lidgett), found on roots of *Daphne* in Victoria. This is about 4 mm. long, with eight-segmented antennæ, and a fringe of long cotton-like filaments on each side of the body. Lidgett's figures are extremely crude, and Froggatt states that the type is lost.

Trionymus angustus is a very small species, but without very striking characters. In shape and general appearance it closely resembles *T. danthoniæ* and *T. diminutus* described by Morrison, but the antennæ are proportionately very much larger than in these species. The antennal segments 3 to 6 are broader than long, and the second, though distinctly longer than broad, is very stout. Thus, the species departs widely from *T. danthoniæ* and comes nearer to *T. diminutus,* in which, however, the third segment is longer than broad. *T. angustus* is also remarkable for the single, long and strong, bristle on each caudal lobe, and the possession of only a single pair of cerarii. In the last character it agrees with certain Californian species, and rather closely approaches *T. distichlii* Ferris, a species with seven-segmented antennæ, of which neither the size nor the shape is given.[1] The cerarian spines are slender, which would make the species run to *T. distichlii* in the table given by Ferris (1918). *T. angustus* and *T. distichlii* are both forms in which the cerarian structures are reduced nearly to a minimum, but whether they reached this condition independently or represent a natural division of the genus it is impossible to say.

Pseudococcus hystricosus, new species

FEMALE (from slide mounts).—Ovate; length 1.5 mm., width 1 mm.; derm quite clear, but with numerous triangular glands scattered over the dorsal and ventral surfaces, also short spines and occasionally long hair; 25–27 large ocular wax-glands

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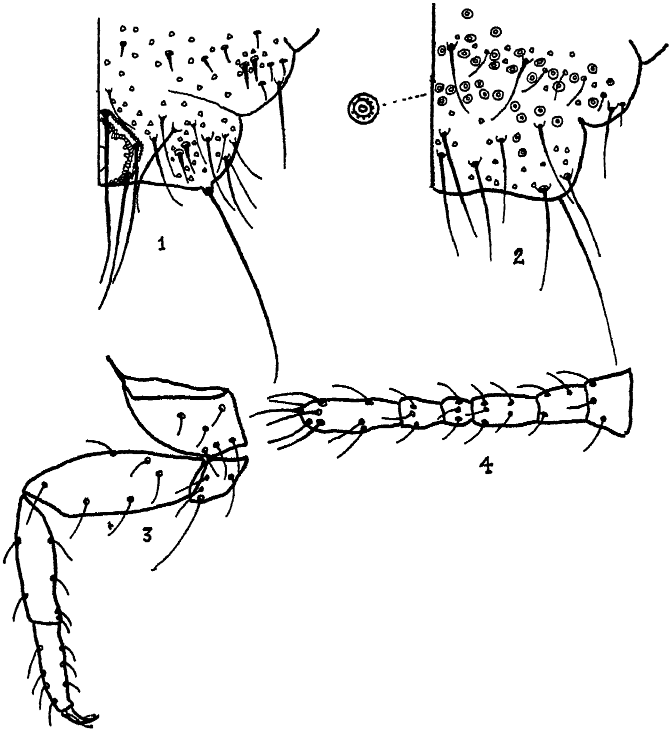
[1] Ferris states that he had *T. distichlii* from La Jolla, determined by Cockerell as *Pseudococcus salinus.* He was aware that this was only a field determination, the material coming from the type-locality of *P. salinus,* and having superficially the same appearance.

on the ventral side of the last abdominal segment immediately posterior to the genital opening, 28–32 on the second segment anterior to the genital opening, sparse on the third and fourth segments; antennæ six-segmented; average lengths of segments examined in microns: (1) 48; (2) 45; (3) 53; (4) 20; (5) 35; (6) 78; formula 6, 3, 1, 2, 5,4; each joint has stout, curved bristles; segments two and three each with two whorls of curved bristles; sixth segment with three whorls of curved bristles and a group of slender straight bristles at the end; legs not unusual and with small stout bristles; the middle leg with measurements given in microns as follows: coxa with five bristles, length of coxa 60; trochanter with three short bristles and one long bristle 70 in length; length of trochanter 45; femur quite stout, with six short bristles, length of femur 150; tibia with three whorls of bristles, length of tibia 115; tarsus with three whorls of bristles, length of tarsus 80; claw simple, digitules small; beak two-segmented and with numerous stiff bristles at the end, length 150 microns, width 100 microns; caudal bristles stout; anal lobes protruding slightly from the margin of the body, apical seta 270 microns long; anal ring with inner and outer pore-bands, outer band with a tube-like duct in each pore; 6 anal ring-setæ, 125–150 microns in



Figs. 1 to 4. *Pseudococcus hystricosus*, new species.

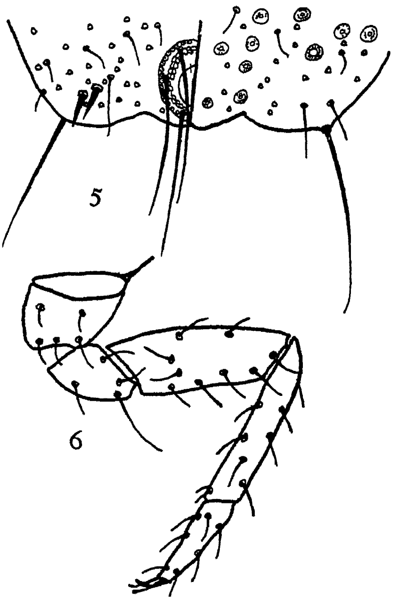
1, dorsal aspect of posterior portion of abdomen of female; 2, ventral aspect of posterior portion of abdomen of female; 3, middle leg of female; 4, antenna of female.

length; seventeen pairs of cerarii, each cerarius of two conical spines and a few triangular wax-glands; one pair of cerarii lateral of antennæ, one pair between the antennæ.

Jenolan, New South Wales, April 29, 1928, (W. P. Cockerell). The locality is in the vicinity of the famous Jenolan caves. Two specimens on the slide; the holotype is the one with antennæ pointing in different directions (Amer. Mus. No. 28458).

Trionymus angustus, new species

FEMALE (from slide mounts).—Body elongated, narrow, sides subparallel; length when mounted 2 mm., width .6 mm.; derm quite clear with the usual type of triangular wax-glands scattered thinly over the surface; ocular wax-glands very numerous on the ventral side of the abdominal segments; as many as 80–100 glands on the ventral side of the last three segments, gradually becoming fewer on the abdominal segments toward the anterior end; antennæ eight-segmented; average lengths of segments examined in microns: (1) 45; (2) 47; (3) 23; (4) 20; (5) 30; (6) 22; (7) 31; (8) 70. The middle leg with the measurements given in microns is described as follows: coxa with five bristles, total length of coxa 65; trochanter with three short bristles and one very long bristle of about 70 microns, length of trochanter 40; femur with nine bristles, length of femur 180; tibia with three whorls of hairs, length of tibia 150; tarsus with three whorls of hairs; length 75; claw normal with two slender digitules which project slightly beyond the claw and have a medium-sized knob on



Figs. 5 and 6. *Trionymus angustus*, new species.

5, anal lobe cerarius and anal ring of adult female (left), and ventral view of anal lobe (right); 6, middle leg of adult female.

each; legs not unusual, all of them with stout bristles; beak or labium about as broad as long and forming an equilateral triangle, two-segmented; one pair of cerarii which are located on anal lobes; each cerarius composed of two slender spines and a few triangular wax-glands; anal ring with inner and outer pore-bands, outer pore-band with an elongated duct in each pore; 6 anal ring-setæ, 75–80 microns in length; anal lobes slightly protruding, apical seta of each lobe 120–130 microns long.

Jennings, New South Wales, April 25, 1928, (W. P. Cockerell). Two specimens found under a stone in an open grassy field. The holotype is the one with both antennæ perfect (Amer. Mus. No. 28459).

The types of both species are in The American Museum of Natural History.

Because of the eight-segmented antennæ and the relative lengths of tibia and tarsus, this is, no doubt, a mature form.

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HOLMESINA SEPTENTRIONALIS, EXTINCT GIANT ARMADILLO OF FLORIDA

By George Gaylord Simpson

In 1888 Joseph Willcox collected certain scutes of a fossil edentate on Peace Creek in Florida and forwarded them to Joseph Leidy who described them (1889A) as *Glyptodon septentrionalis.* Later Leidy (1889B) recognized that they did not belong to a glyptodont but to a gigantic armadillo and referred them to *Chlamytherium humboldtii* Lund, a species described from cave deposits in Brazil. This remained the status of this remarkable discovery until 1915, when Sellards (1915) described part of a lower jaw and some scutes from Vero, Florida, and mentioned material from other parts of the state. He showed that the species was not synonymous with that from Brazil, and revived Leidy's first name in the form *Chlamytherium septentrionale.* In 1922 Cahn described a good lower jaw supposedly of this species in Texas, and in 1926 Hay reported a second Texas occurrence, including a partial lower jaw with four teeth. The present writer has mentioned or figured various remains from Florida (Simpson, 1928, 1929A) and has listed twelve occurrences of the species in that state (1929B).

The work of Mr. Walter W. Holmes in Florida has resulted in finding large numbers of scutes and some other remains of this great armadillo. Some of these have already been mentioned in print, as cited in the preceding paragraph, and the scutes will be described in more detail in a forthcoming joint paper (Holmes and Simpson). In the present paper will be described a lower jaw, maxilla, and premaxilla recently found in Florida by J. E. Moore and added to the Holmes Collection of the American Museum. This specimen is the most complete yet found in North America and serves not only to define the species with greater precision but to indicate its true place among the chlamytheres as lately revised by Castellanos (1927). It proves not only to be totally distinct from *Chlamytherium humboldtii,* but to represent a new genus under the system established by Castellanos.

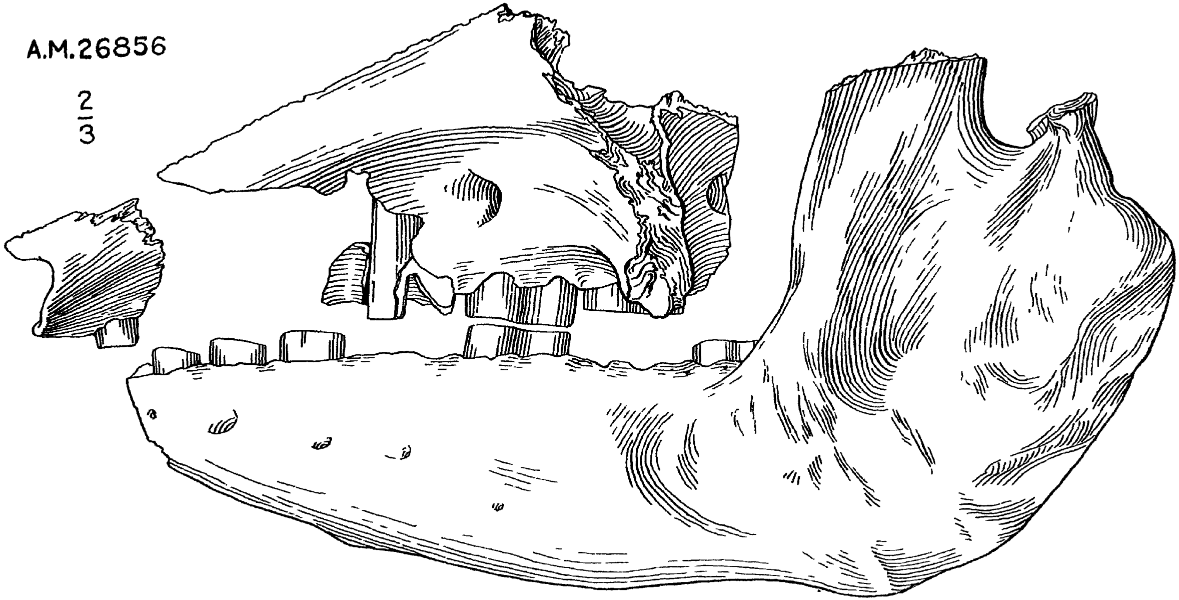

Fig. 1. *Holmesina septentrionalis* (Leidy). Premaxilla, maxilla, and mandible of neotype, Amer. Mus. No. 26856. Left lateral view. The premaxilla is reversed from the right side. Two-thirds natural size.

HOLMESINA,[1] new genus

TYPE.—*H. septentrionalis* (Leidy).

DIAGNOSIS.—A chlamytheriine armadillo most nearly related to *Kraglievichia* and *Chlamytherium*. One tooth in premaxilla. Fifth, sixth, and seventh upper teeth subequal, with vertical external and internal grooves, the internal well-defined, narrower and more anterior than the external. Second lower tooth subovate, with faint internal groove. Third and fourth with distinct internal grooves, obliquely truncated posterior sides, no external grooves. Fourth larger than third, much smaller than fifth. Ninth lower tooth small (about equal to fourth) pyriform, with posterior lobe smaller than anterior. Maxillo-premaxillary suture as in *Kraglievichia*, unlike *Chlamytherium*. Symphysis relatively shorter than in *Chlamytherium*, lower dental series convex upward. Scutes strongly pitted, with distinct but usually rounded keels.

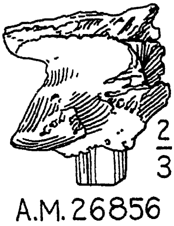

Fig. 2

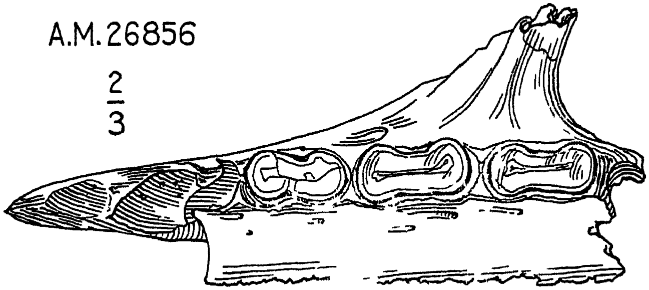

Fig. 3

Fig. 2. *Holmesina septentrionalis* (Leidy). Right premaxilla of neotype. Amer. Mus. No. 26856. Internal view. Two-thirds natural size.

Fig. 3. *Holmesina septentrionalis* (Leidy). Left maxilla of neotype, Amer. Mus. No. 26856. Palatal view. Two-thirds natural size.

DESCRIPTION OF NEW SPECIMEN

The specimen on which the above diagnosis was based may be designated neotype of *Holmesina septentrionalis*, and the following description will fix the distinctive characters, which are hardly discernible from the original types of Leidy, isolated scutes. This specimen, Amer. Mus. No. 26856, includes the left lower jaw complete except for the extreme anterior end and the tip of the coronoid. It contains half of the first alveolus and all of the other alveoli, with the second, third, fourth, sixth, and eighth teeth in place. Associated is the complete right premaxilla with its included tooth and most of the left maxilla, including much of the palatal process, but with both ends incomplete, with most of the fifth tooth and all of the sixth and seventh. An isolated tooth

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[1] For Walter W. Holmes, in recognition of eight years of intensive work in the Pleistocene of Florida, with special emphasis on the edentates.

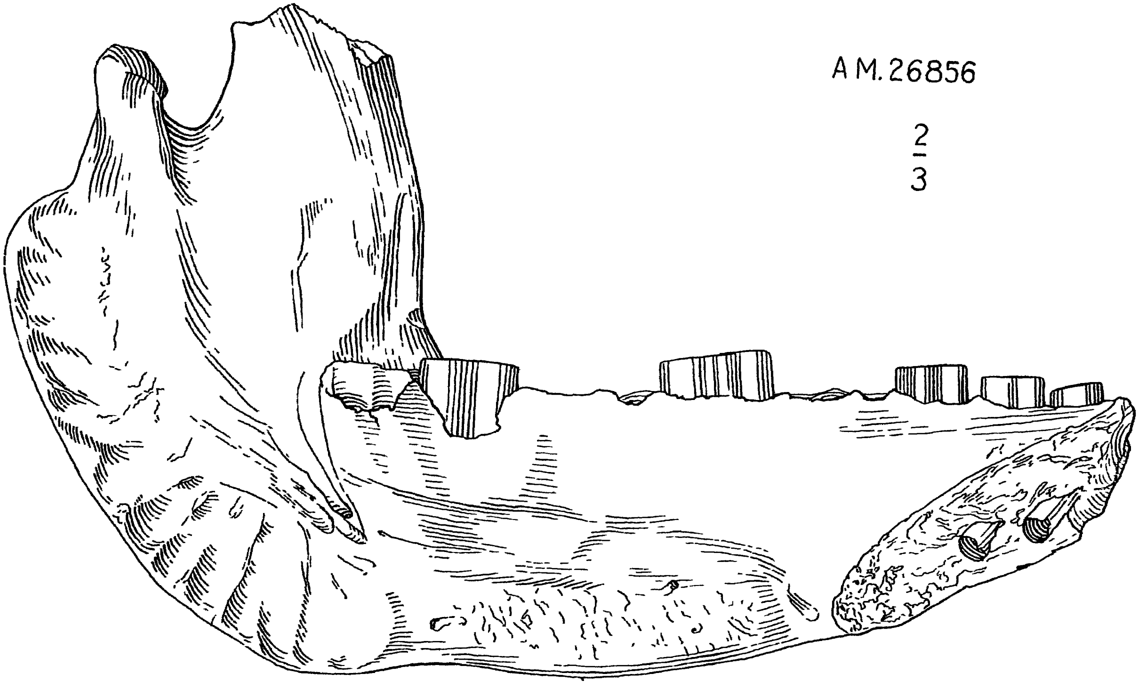

Fig. 4. *Holmesina septentrionalis* (Leidy). Left lower jaw of neotype, Amer. Mus. No. 26856. Internal view. Two-thirds natural size.

(apparently fifth right upper) probably belongs to this individual, and various scutes and isolated bones were found in the same pit. The locality is in Manatee County, about one mile south of the business district of Bradenton and one-quarter mile east of the Tamiami Trail, near Florida Avenue. The specimen was found with typical associated material of the Melbourne Fauna in the same stratum as the types of *Parelephas floridanus* (see Simpson, 1930) and near that type locality. The present locality is designated by Holmes as the Florida Avenue pit of the Bradenton Field.

The premaxilla is small. Its nasal suture is straight and nearly parallel to the alveolar border. The bone is notched anteriorly and its anterior lower part curves inward markedly. The palatal portion is narrow, indicating a width of 10 or 12 mm. between the opposite first aveoli, between which are the small anterior palatal foramina. The anterior tips of the two premaxillæ were not in contact. The maxillary suture begins above the boss of the upper end of the first aveolus and opposite the middle of the protruded part of the second tooth. It curves forward and passes between the first and second teeth, then backward to a point at about the middle of the second. The second tooth is thus excluded from the premaxilla, but its aveolar walls are partly clasped by premaxillary processes. The arrangement is much as in *Kraglievichia* but unlike *Chlamytherium* in which there are said to be two teeth in premaxilla.

The first tooth, wholly in the premaxilla, curves inward and forward. In section it is oval, the larger part posterior, with a very slight vertical anterointernal groove. Its greatest diameter is 9.5 mm.

The maxilla has an upper part, which narrows anteriorly and apparently continued the curved surface of the nasals, an alveolar part, which lodges the teeth and from which the zygoma springs, and a palatal part. The facial exposure of the alveolar part in front of the zygoma is hollowed out and separated from the upper part by a curving angulation. The zygoma arises chiefly opposite the seventh tooth and its base contains a large sinus. The infraorbital canal is 44.5 mm. in length, entering the bone above the anterior half of the eighth and leaving it above that of the sixth tooth. The palatal part is thick, long, and narrow. From the inner edge of the sixth alveolus to the midline is about 15 mm.

The sixth upper tooth is 21.8 mm. in anteroposterior diameter, the fifth and seventh slightly less. These teeth are bilobed in section. On the sixth, the external surface is marked by a broad and faintly double vertical groove near the middle, the internal by a narrower and single groove somewhat more anterior in position. The seventh is similar but with the external groove more distinctly double, while on the fifth it is single. The total height of these teeth (which are, of course, rootless) is about 47.50 mm., of which only 3 or 4 mm. protruded from the alveoli.

The lower jaw agrees in essentials with that previously described by Sellards (1915). The angular expansion extends somewhat farther upward and the condylo-angular notch is a little more distinct. The anterior border of the coronoid is somewhat less inclined. The vacuity on the internal surface opposite the eighth tooth, present in most previous specimens of this subfamily (including those of Sellards and of Cahn referred to this genus), is absent. Since this transmits no vessels or nerves, its absence may well be fortuitous, although it was given taxonomic value by Sellards.

The first four lower teeth of *Holmesina septentrionalis* differ significantly from those of any of the Pliocene or Pleistocene South American species. The third and fourth are of nearly equal size, as in *Vassallia,* somewhat less unequal than in *Chlamytherium* and considerably less than in *Kraglievichia.* The fourth is larger relative to the fifth than in *Vassallia,* slightly smaller than in *Chlamytherium,* and much smaller than in *Kraglievichia.* The first tooth probably and the second certainly agree rather well with *Chlamytherium* in form. The third is more complex than in the South American genera. There is a well defined internal groove, somewhat in advance of the middle, and the posterior end is formed by an oblique anterointernal-posteroexternal surface, gently concave in horizontal section, which appears to truncate the tooth. The fourth tooth is also unique. In *Vassallia* it is like the third and simply oval. In *Kraglievichia* and *Chlamytherium* it is quite unlike the third and grooved on both sides. In *Holmesina* it is like the third, grooved internally, truncated posteriorly, evenly convex externally. The internal groove is sharper than on the third and rather more posterior, and the truncation better defined. The fifth to eighth teeth most nearly resemble those of *Kraglievichia.* The fifth, grooved externally only in *Vassallia* and *Chlamytherium,* is grooved on both sides, the internal sharper, deeper, and more anterior. The sixth has a large, broad, median external groove and three shallow, narrow internal grooves, the middle one least well defined. The seventh has a similar external groove and a single more shallow internal groove in advance of the midline. The eighth is similar but has a second very vague internal groove posterior to the first. The ninth tooth is somewhat smaller relative to the eighth than in *Chlamytherium,* larger than in *Kraglievichia.* Its form is like that of

Vassallia or *Kraglievichia*, pyriform, grooved on both sides, with the posterior lobe smaller.

The lengths (horizontal anteroposterior diameters) of the teeth follow. Those marked * are internal measurements of the alveolus below the mouth where the walls are parallel and closely approximated to the tooth.

Tooth or alveolus	Length
2	10.2
3	12.2
4	13.5
5	19.6*
6	22.3
7	22.4*
8	19.1
9	13.0*

The order of length is thus 6=7, 5, 8, 4, 9, 3, 2, (1). Castellanos gives the following order for type species of the other genera in question:

Chlamytherium: 6, 7, 5, 8, 4, 9, 3, 2, 1.
[Winge's figures for *C. majus* give the same order.]
Kraglievichia: 6, 7, 8, 5, 4, 9, 3, 2, 1.
Vassallia: 6, 7, 8, 5, 9. 4=3, 2, 1.

The length of the jaw as preserved is 228. mm. and estimated total length about 240 mm. The size is approximately that of *Chlamytherium humboldtii* and somewhat smaller than *C. giganteum* (or *majus*), the largest known armadillo.

RELATIONSHIPS

It is obvious that *Holmesina septentrionalis* is related to *Chlamytherium*. It was formerly referred to the type species of that genus, and even after specific separation was established, it continued to be placed in *Chlamytherium*. The Pliocene and Pleistocene of South America contain a series of some nine, or fewer, species which form the dasypod subfamily Chlamytheriinæ. The range of differentiation is not great, and earlier work placed all the species, from the lower Pliocene to the subrecent, in the single genus *Chlamytherium*.[1] Recently Castellanos (1927) has published a preliminary revision of the subfamily in which he divides the Pliocene forms into two new genera and restricts the name *Chlamytherium* to the Pleistocene species. *Vassallia* (type, *Chlamytherium minutum* Moreno and Mercerat) occurs in the Araucanian, and

---

[1] Generally written *Chlamydotherium*, but the original spelling was that here used.

Kraglievichia (type, *Chlamytherium paranense* Ameghino) in the Enterian and Monte Hermoso. *Chlamytherium* (type, *C. humboldtii* Lund; synonym *Pampatherium,* type *P. typum* Ameghino) occurs in the Pampean of Argentina and caves of Brazil.

If these three types of chlamytheres be retained in a single genus, then the Florida form belongs in that genus. If Castellanos is followed,

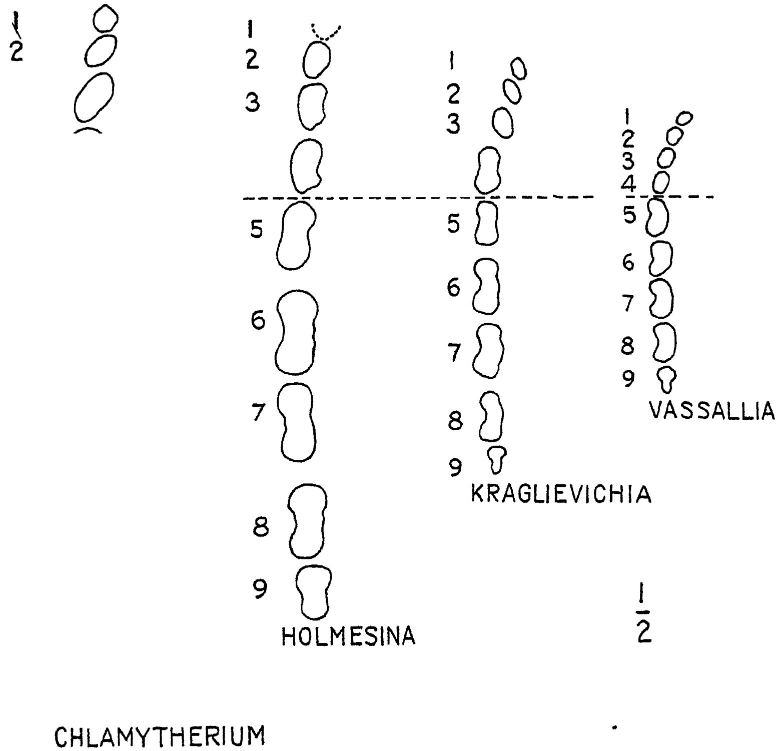

Fig. 5. Chlamytherinæ. Comparative series, showing crown outlines of left lower teeth of the four known genera. For ease of comparison the dentitions have been placed on a base line passing between the fourth and fifth teeth. All but *Holmesina* are redrawn after Castellanos. One-half natural size.

which is probably preferable if not obligatory, then the Florida species cannot be referred to any of his three South American genera, for it differs from them as much as they differ among themselves.

Except in the size of its type species, *Holmesina* resembles *Kraglievichia* somewhat more closely than it does *Chlamytherium.* The osteology of the known parts generally agrees with *Kraglievichia.* The only really distinctive feature is the maxillo-premaxillary suture. This is very different in the two genera as described by Winge and Castellanos, and *Holmesina* agrees much more nearly with *Kraglievichia*. The differentiation in form of the first four lower teeth, as described above, is quite different from that of any South American form but is more readily derivable from the more primitive Pliocene genera than from *Chlamytherium*. The following five teeth agree fairly well in form with *Kraglievichia* and differ characteristically from *Chlamytherium*.

The most valid conclusion on present evidence is that *Chlamytherium* and *Holmesina* represent equally advanced but distinct lines of differentiation from the Pliocene chlamythere stock. With increasing knowledge (and increasing taxonomic refinement) of animals participating in the Neotropical-Holarctic interchange, such a relationship is proving common, although not invariable. The Pleistocene or Recent animals of groups spreading over the two continents often prove to be of distinct genera tracing their common origin to a Pliocene or late Miocene stock on one of the continents.

The wider relationships of the chlamytheres constitute a problem of considerable difficulty, necessitating examination of more material than is available to me. Ameghino traced the subfamily to his genus *Machlydotherium* (an anagram of *Chlamydotherium*) from the Oligocene *Astraponotus* beds. So far as I know, this genus has not been adequately described or figured and judgment is suspended, but Castellanos accepts the relationship. Various Santa Cruz genera have been considered as related to the chlamytheres, such as *Proeutatus* (by Winge), but the relationship is not direct and is very uncertain.

The structure of the chlamytheres is wholly armadilloid, and their removal from the family Dasypodidæ is not warranted. The retention of true incisors is not unique, and a similar but less marked tendency toward tooth complication is evident in some other dasypod lines. There does not seem to be any valid evidence for the view often expressed, supported by Ameghino and quoted with approval by Castellanos, that the chlamytheres are intermediate between armadillos and glyptodonts or derived from the specifically proto-glyptodont armadilloid stock. The chlamytheres are typical armadillos; their convergence toward the glyptodonts is very slight, superficial, and not confined to them. The glyptodonts appear to have been fully distinct in the Oligocene, while only late Pliocene or Pleistocene chlamytheres show even a limited degree of resemblance to that group.

The chlamytheres are the largest and in this and some other respects the most progressive of all the armadillos.

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PARELEPHAS FLORIDANUS FROM THE UPPER PLEISTOCENE OF FLORIDA COMPARED WITH *P. JEFFERSONII*

BY HENRY FAIRFIELD OSBORN

The fossil mammoths hitherto discovered in Florida have recently been determined by Osborn as belonging either to *Archidiskodon imperator*, which is relatively rare, or to the typical *Parelephas columbi*. The present description relates to a new Upper Pleistocene stage of *Parelephas* represented by the remains of seven individuals varying in sex, in size and in age but all distinguished by a ridge plate formula, M 3 $\frac{22+}{21+}$, as compared with the typical *Parelephas columbi*, M 3 $\frac{19}{16+}$, or with *A. imperator*, M 3 $\frac{18+}{19+}$. The type and paratype skulls (Fig. 2) indicate animals of very large size with crania and tusks exceeding in size and proportions those of any *Parelephas* hitherto discovered, excepting perhaps the "Franklin County Mammoth," *P. jeffersonii*, Nebraska Museum 1–4–15.

This fine type collection is a gift of Mr. Walter W. Holmes of St. Petersburg, Florida, who with enthusiasm and generosity has been promoting the American Museum explorations in Florida since the year 1923. The deposit near Bradenton, Florida, yielding the type, paratype and other specimens was found in February of 1929 by Mr. J. E. Moore of Sarasota, Florida, who discovered the palate of the specimen now known as Amer. Mus. 26821 protruding from the side of the bank of a drainage canal. This deposit, composed chiefly of fine white river sand and black soil, was thoroughly worked by our collector, Mr. Carl Sorensen, during the period March 2 to April 2, 1929, where he recovered the remains of at least seven individual elephants. The whole deposit is 27 feet broad and 10 feet deep, the fine white river sand filling the interstices of the more or less broken crania. All the specimens have been fractured to a greater or less degree, transported a considerable distance, and collected in what may have been a deep marginal pool of a low gradient river.

Seven individuals, including type and paratype, are represented by parts of crania, jaws and the included grinding teeth. The principal dental

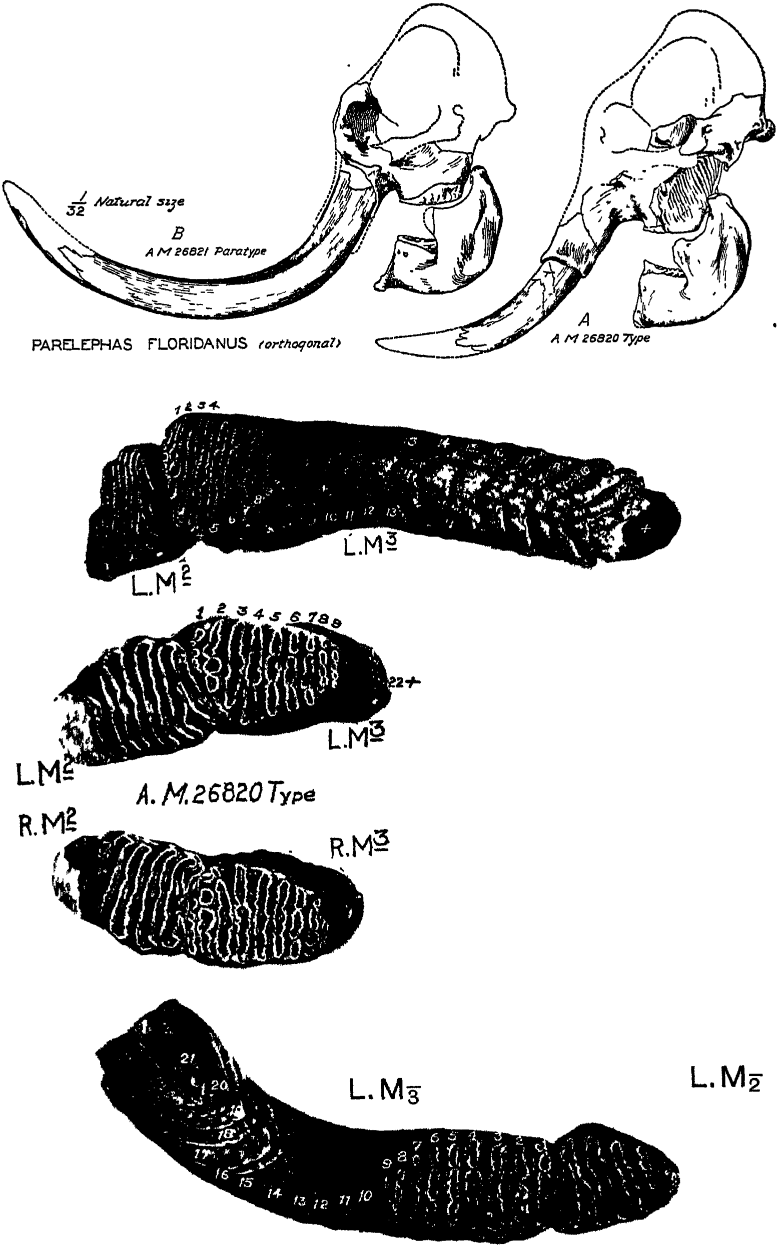


Fig. 1. Original type and paratype figures of *Parelephas floridanus* (Amer. Mus. 26820, 26821). Crania one thirty-second natural size; type dentition one-sixth natural size; paratype, *B*, reversed in drawing. After Osborn, Amer. Mus. Nov. No. 393, December 24, 1929, page 19.

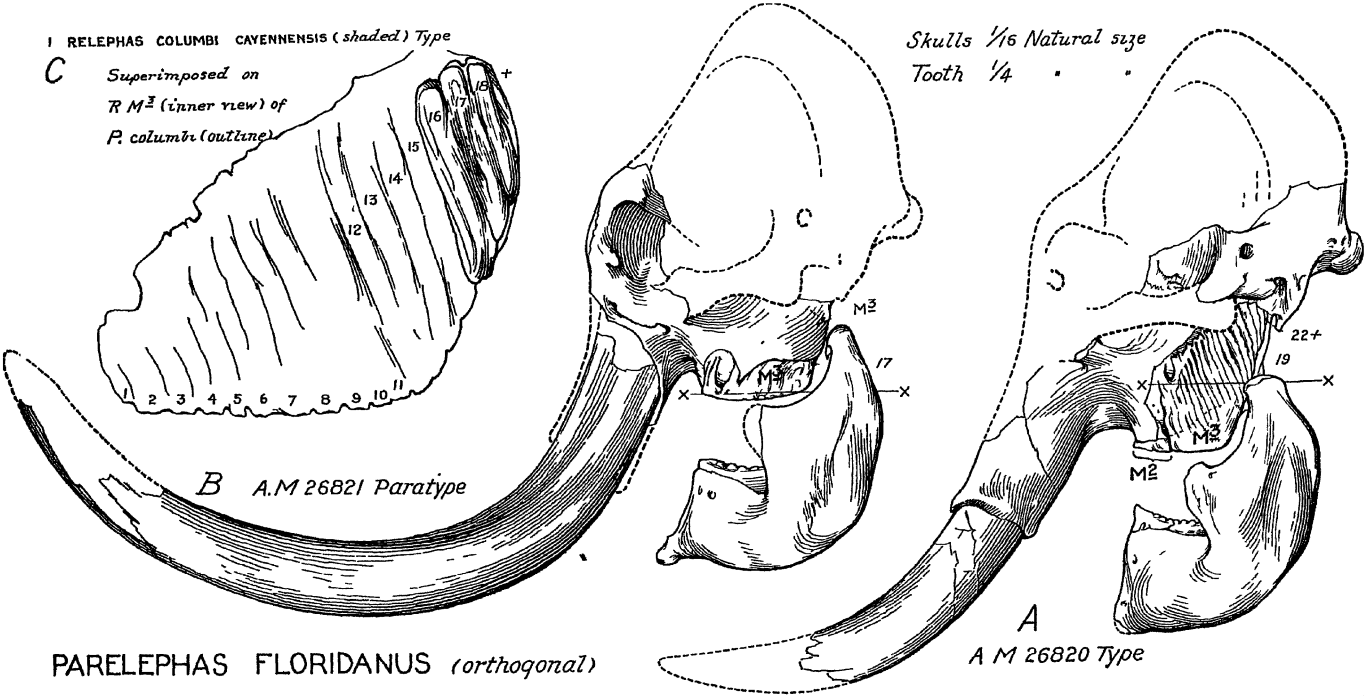


Fig. 2. Type (Amer. Mus. 26820) and paratype (Amer. Mus. 26821) crania and jaws of *Parelephas floridanus*, one-sixteenth natural size; compared with type (*C*) of *Parelephas columbi cayennensis*, one-fourth natural size.

The type (*A*) is a middle-aged adult exhibiting M^2 still in use and M^3 just coming into function; the line, x——x, indicates the occlusal level of the molar crown in the aged paratype (*B*) in which the tusks attain full length.

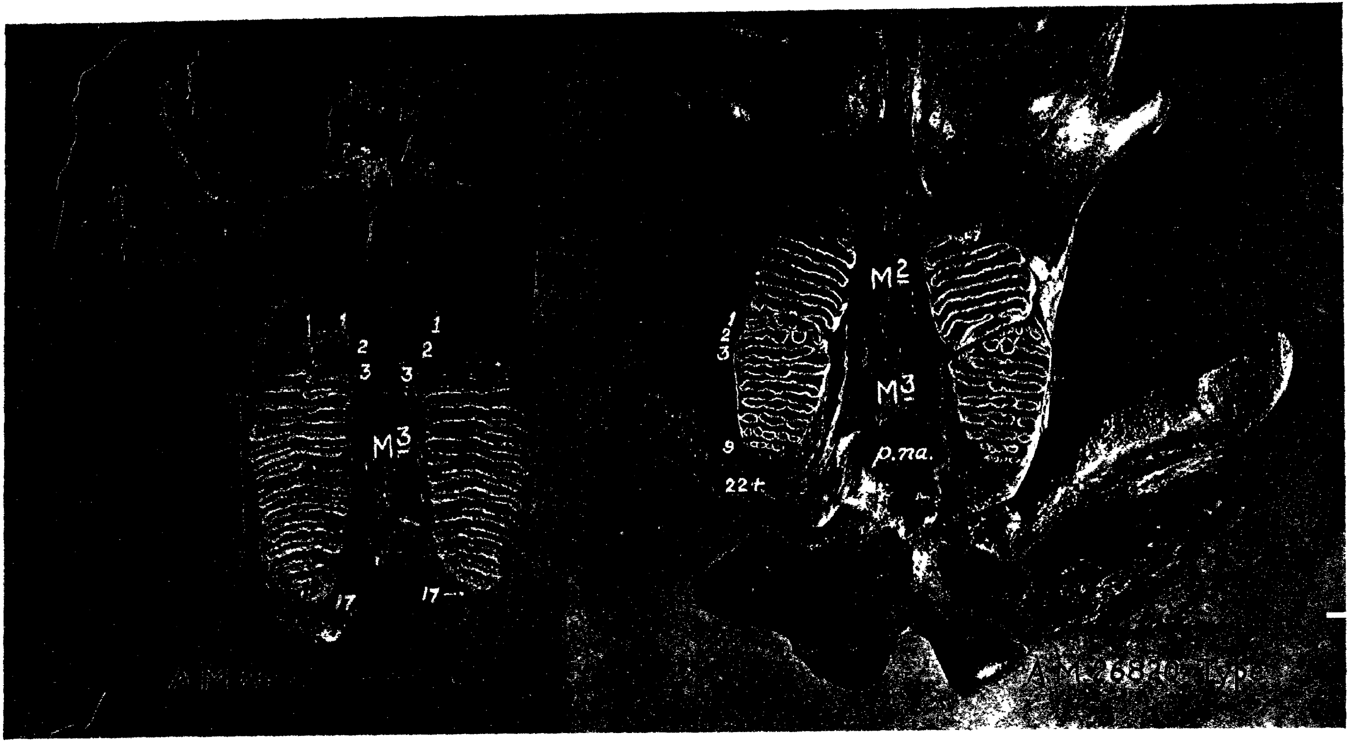


Fig. 3. Type (Amer. Mus. 26820) and paratype (Amer. Mus. 26821) in palatal aspect, one-sixth natural size.

(Right) Molar crowns of the middle-aged adult type in which a total of fourteen ridge plates are in use in the closely conjoined M^2 and M^3, which appear to function like a single grinder. (Left) Aged paratype in which the 16–17 plates of the single third superior grinder M^3 are simultaneously in function. Compare figure 2 showing the attrition level of the grinders in the middle-aged adult and aged specimens.

measurements are shown in Table I; the principal skeletal measurements are shown in Table III.

Important as bearing on the geologic age of this deposit are the horn and part of the cranium of a very large bison (perhaps *Bison regius*), also part of the cranium of *Castoroides*. Dr. G. G. Simpson, who has recently surveyed the mammalian deposits of Florida with the aid of Mr. Herman Gunter, considers this deposit as probably of late Pleistocene age.

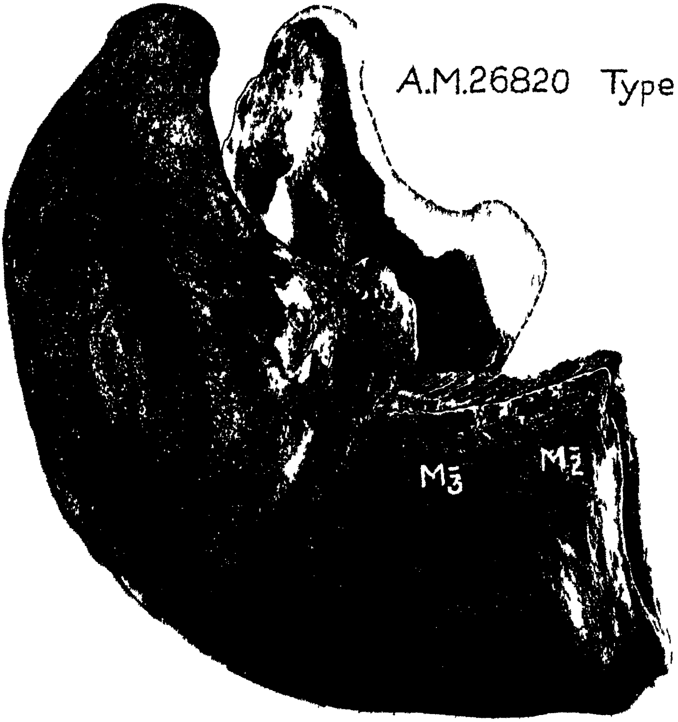


Fig. 4. *Parelephas floridanus.* Mandible of type (Amer. Mus. 26820), exhibiting partly worn M_2, M_3, with strongly abbreviated rostrum.

The chief materials are as follows:

Amer. Mus. 26820. Type. middle-aged male. Skull and jaws (Figs. 1, 2, 3) which may be associated with Amer. Mus. 26820*a*, namely, ribs, l. scapula, l. fibula,

r. ulna, l. radius, two humeri, r. femur, two tibiæ, parts of pelvis, and certain foot bones of the skeleton. Smaller right femur, length 1250 mm. (4 ft., 1¼ in.). Smaller right humerus, length 1100 mm. (3 ft., 7¼ in.)

Amer. Mus. 26821. Paratype. Palate and jaws of an old male individual, third superior and inferior molars only, which may be associated with Amer. Mus. 26821*a*. Right side of cranium (Figs. 1, 2, 3), palate, lower jaw, very large tusk, also associated large vertebræ (26833*b* in measurements below). Also larger left femur (1393 mm.) Larger left humerus complete, length 1200 mm. (3 ft., 11¼ in.).

Amer. Mus. 26822. Palate with r M^3 and l.M^3, of smaller size, supposed female.

Amer. Mus. 26823. Portion of right palate, with r M^3, of larger size, supposed male.

Amer. Mus 26824. Half of right palate, with r.M^3, of small size, supposed female.

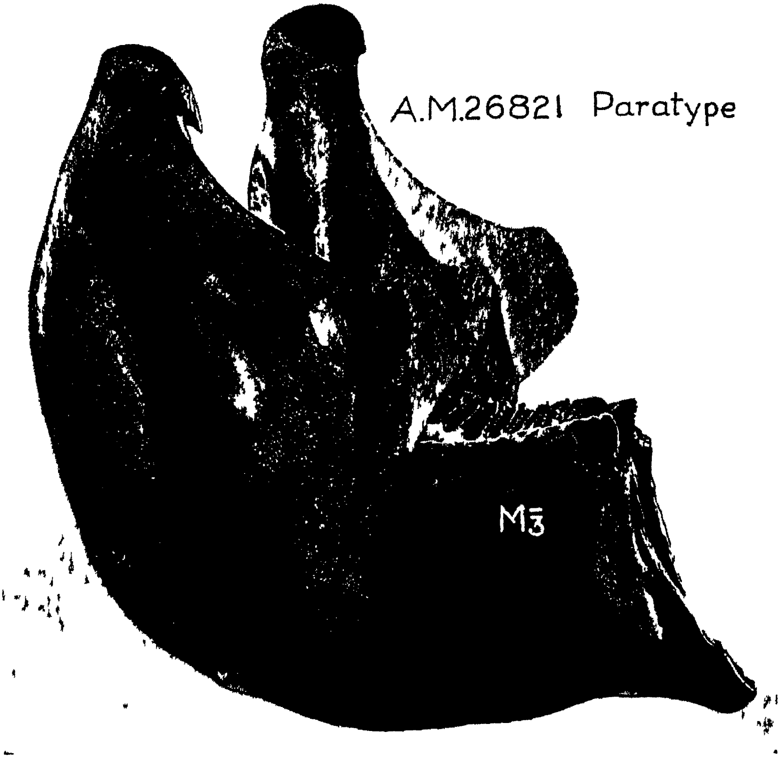


Fig. 5. *Parelephas floridanus.* Deeply depressed aged mandible of paratype (Amer. Mus. 26821), exhibiting M_3 *in situ,* with prominent rostrum.

Observe the relatively greater depression of the lower border of this mandible below the level of the condyle, a bathycephalic adaptation.

Amer. Mus. 26825. Third left upper, l.M^3, and left lower grinder, l.M$_3$, complete, broad plated, of largest size, supposed male.

Amer. Mus. 26826. Right lower grinder, r.M$_3$, incomplete, middle-sized, supposed male.

Amer. Mus 26833 *a, b, c, d, e, f*. Five vertebral series, scattered. See description and Table II on page 13.

COMPARATIVE CRANIAL MEASUREMENTS OF *P. floridanus* AND *P. jeffersonii*

As shown in Table III and figure 2 and figure 8, the crania and jaws of *P. floridanus* greatly exceed in size and in massiveness the aged type cranium of *P. jeffersonii*. The ratio of increase in size in the jaw across the premaxillaries is about 10 per cent. The estimated bathycephalic measurement from the summit of the occiput to the occlusal surface of the grinding teeth is 1000 mm. *e.* as compared with 880 mm. in *P. jeffersonii*. The brachycephalic measurement from the occipital condyle to the anterior rim of the orbit is 770 mm. *e.* as compared with 720 mm. in *P. jeffersonii*. It thus appears that *P. floridanus* is much more bathycephalic than the relatively primitive *P. washingtonii*.

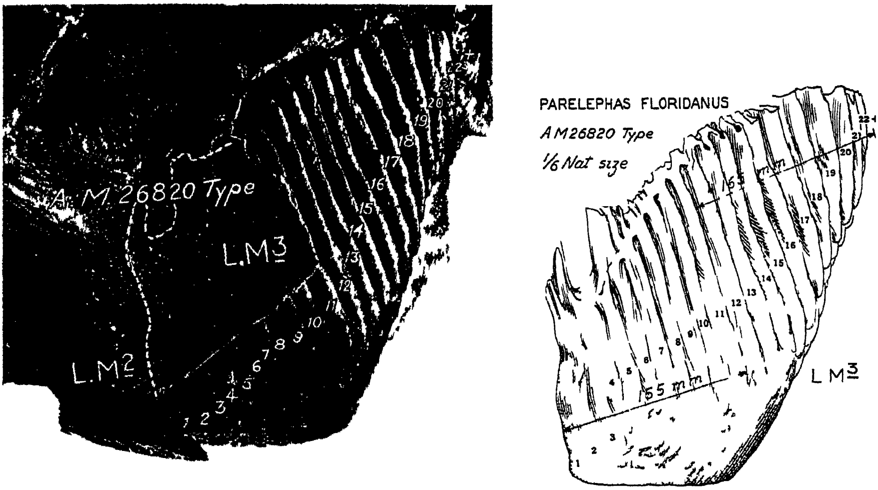


Fig 6. (Left) Detailed photograph and (right) study of the left second, l.M^2, and third, l M^3, superior grinders of the type (Amer. Mus. 26820) exhibiting a total of 22+ ridge plates in l.M^3, one-sixth natural size.

Compare figure 2, *A*. (Right) Third left superior molar of type indicating the true method of measuring the *length* of a true superior molar crown, namely, eleven ridge plates on the lower level = 155 mm.; eleven ridge plates on the upper level = 165 mm.; the total length of this third superior molar, accordingly, is 320 mm.

Increasing *bathycephaly* is also indicated in the mandible by comparison of the type jaw (Fig. 4) adult bull of middle age, exhibiting the partly worn M_2 and M_3, with strongly abbreviated rostrum. Much deeper or more bathycephalic is the aged paratype jaw (Amer. Mus. 26821, Fig. 5) retaining only the much worn third inferior molar, M_3.

Dentition of Seven Incomplete Cranial and Mandibular Specimens. Table I

The true method of measuring third superior molars, M^3, is shown in figure 6 (right) in connection with the actual enumeration of the ridge plates (left).

Measured in this way the very large male third superior molars, M^3, of the type and paratype are as follows:

Type: M^3
Length =320 mm.
Maximum breadth = 88
Maximum height =235

Paratype: M^3
Length =320+
Breadth = 99
Height =215+

In contrast, the smaller female superior molars of Amer. Mus. 26822 measure:

Length =278+ mm.
Breadth =106
Height =184+

The third inferior molars, M_3, measure:

Type: M_3
Length =290
Breadth = 79
Height =180

Paratype: M_3
Length =290
Breadth = 92
Height =180

Table I also shows the total number of ridge plates in M^3, 22+; in M_3, 21+ - 22. In ridge plate count of type and paratype taken along the central line of crown, 7½ ridge plates in 10 cm.; in smaller males and females, 6½ ridge plates in 10 cm. Inferior ridge plate count, M_3, 6½ ridge plates in 10 cm. in unworn type; 5½ in worn paratype.

The *specific constancy* of these measurements establish beyond question the clear separation of *P. floridanus* from the more primitive *P.*

TABLE I

PRINCIPAL DENTAL MEASUREMENTS OF SEVEN INDIVIDUALS

Parelephas floridanus and *P. jeffersonii*

Measured as in diagrams, Figs. 6, 7

	Parelephas jeffersonii A. M. 9950 Type Skeleton	*Parelephas floridanus* A. M. 26820 Type Male—middle-aged Skull	*P. floridanus* A. M. 26821 Paratype Male—aged. Skull.	*P. floridanus* A. M. 26822 ? Female. R. & L. M^3	*P. floridanus* A. M. 26823 ? Large male. R. M^3	*P. floridanus* A. M. 26824 ?Female. R. M^3	*P. floridanus* A. M. 26825 ?Large male. L. M_3	*P. floridanus* A. M. 26826 Large male. L.M^3,R.M_3	*P. floridanus* A. M. 26833 Skel. parts.
Third superior molar—length	203+	320	320±	278±				288	
max. breadth. 9th	108+	88	99	106				91	
max. height. 15th	Worn	235	215±	184+				195	
Third inferior molar—length	208+	290	290±		312	273	355	333	
max. breadth. 7th to 9th	86+	79	92		92	99	90	83	
max. height. 12th to 15th	168	180±	180±		200	192	165	170	
Total number of ridge plates. M^3		22	17e	22e	19+	18+		20+	
Total number of ridge plates. M_3		21+	12e				22	21	
Crown:—number ridge plates in 10 cm. M^3		7½	7½	6½	6½	7		6½	
number ridge plates in 10 cm. M_3		6½	5½				6	6½	
Tusk—exposed length, outside curve (free portion)	3020	1165	1960						
total length	3500		2320±						
max. diameter, transverse	$168^{R.}$	180	183						
max. circumference	505	545	$520^{L.}$+						

columbi on the one hand and from the more progressive *P. jeffersonii* and *P. progressus* on the other, as shown in the following comparative ridge plate formulæ:

Parelephas progressus, M 3 $\frac{30}{26}$
Parelephas jeffersonii, M 3 $\frac{25}{24}$
Parelephas floridanus, M 3 $\frac{22+}{21-22}$
Parelephas columbi, M 3 $\frac{19}{16+}$

Incisive Tusks. The tusks are distinguished for their massiveness (Figs. 1, 2, 9), the maximum transverse diameter of the type being 180 mm., of the paratype 183 mm.; and the circumference, 545 mm., as compared with *P. jeffersonii* of which the maximum diameter is 168 mm., and the circumference 505 mm. As newly restored (Fig. 8), the type tusk (Amer. Mus. 26820) is much longer than shown in figures 1, 2. The paratype tusk (Amer. Mus. 26821) is correctly represented in figure 2; it is apparently full-grown, judging from the extreme wear of M^3. It measures 2320 mm. as compared with 3500 mm. of the type of *P. jeffersonii* (Amer. Mus. 9950).

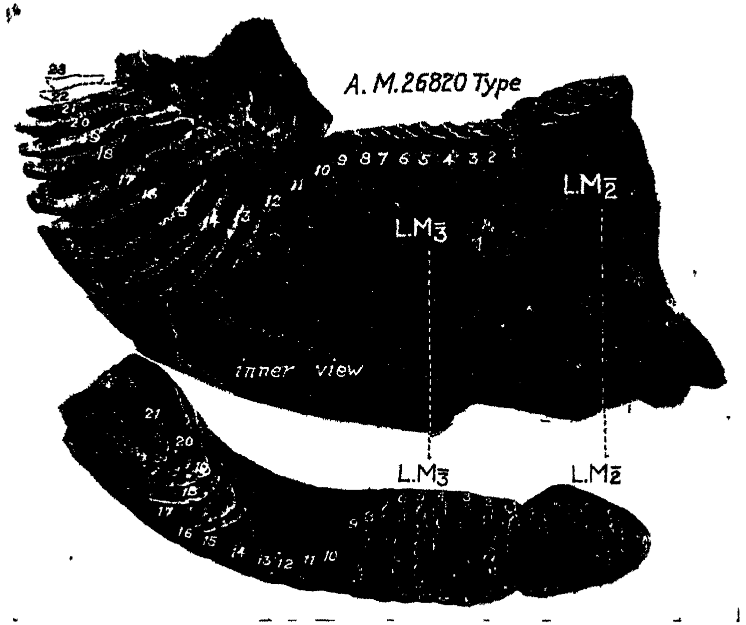


Fig. 7. *Parelephas floridanus.* Type, internal and crown views of second and third inferior grinding teeth, $l.M_2$, $l.M_3$; $l.M_3$ exhibits 21–?23 ridge plates. One-sixth natural size.

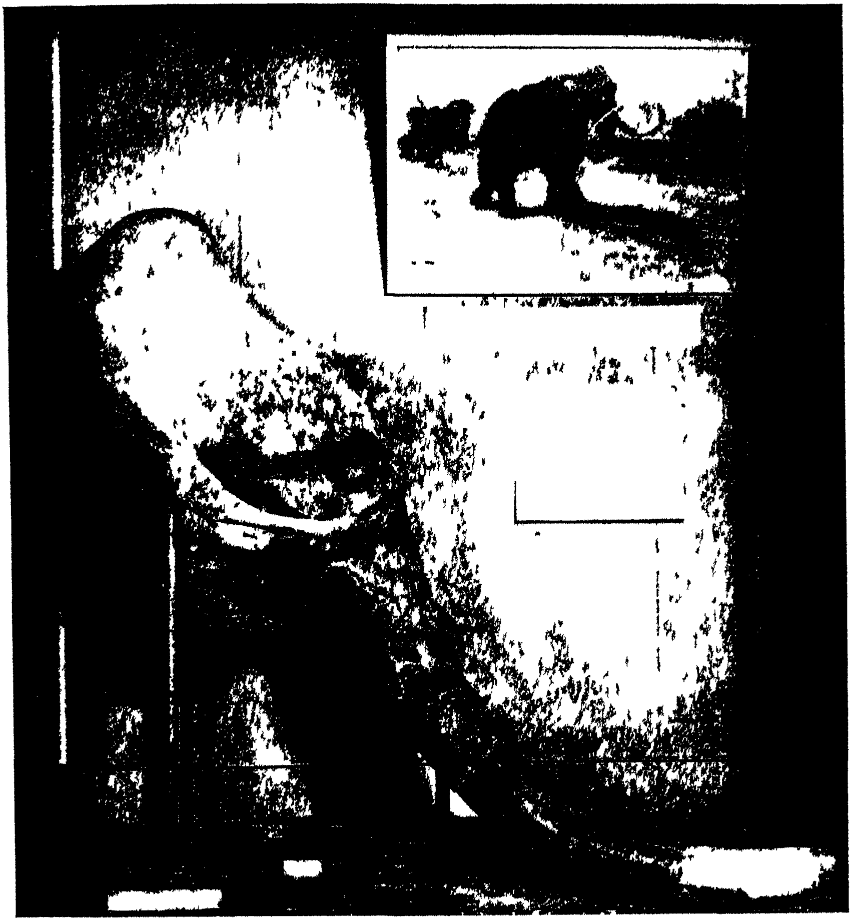


Fig. 8. Reconstructed cranium and tusks of the type (Amer. Mus 26820) of *Parelephas floridanus*, as now exhibited in the Hall of the Age of Man.

In this reconstruction, made under the direction of the author and Mr. Charles Lang, the height of the orbit is determined from the paratype (Amer. Mus. 26821); the frontal profile and occipital region are determined partly from the cranium (Amer. Mus. Cope Coll. 8681) of the more primitive *P. washingtonii*, partly from the type (Amer. Mus. 9950) of *P. jeffersonii*, and partly from the giant *P. jeffersonii* in the Nebraska Museum known as the "Franklin County Mammoth" (Neb. Mus. 1-4-15).

COMPARATIVE SKELETAL MEASUREMENTS OF *P. floridanus* AND *P. jeffersonii*

As shown in Table III, the skeleton and limbs of the type middle-aged bull of *P. floridanus* (Amer. Mus. 26820) exactly equal or slightly exceed in size the very aged bull type of *P. jeffersonii* (Amer. Mus. 9950) measured as shown in figure 9. This statement is proved by the following comparisons:

	Parelephas jeffersonii, type. Aged bull. Amer. Mus. 9950	*P. floridanus*, type. Adult bull. Amer. Mus. 26820	*P. floridanus*, paratype. Aged bull. Amer. Mus. 26821
Humerus, articular length, Right	1120	1140	
Humerus, articular length, Left	1085+	1143	1185
Femur, articular length, Right	1250±	1230	
Femur, articular length, Left	1255		1393
Tibia, articular length, Right	690	698	
Tibia, articular length, Left	685	685	

The aged bull paratype (Amer. Mus. 26821) of *P. floridanus* (left humerus, 1185 mm.; left femur, 1393 mm.) greatly exceeds in size the aged male type (Amer. Mus. 9950) of *P. jeffersonii.* In fact, the measurements of this femur and humerus somewhat exceed those of the Amherst skeleton of *Parelephas columbi* (Amherst Mus. 25–1) and are not far inferior to the measurements of the giant *A. imperator maibeni* of the Nebraska Museum (Neb. Mus. 5–9–22). A few comparative measurements are as follows:

Right humerus of *A. imperator maibeni* of the Nebraska Museum	1230 mm.
Left humerus of aged male *P. floridanus* paratype	1185
Right humerus of type younger male *P. floridanus*	1140
Right humerus of *P. jeffersonii* aged bull	1120
Right humerus of *P. columbi*, Amherst skeleton	1028

These comparative measurements are very important because the humerus always forms the most reliable method of estimating the shoulder height of any member of the elephant family.

FIVE VERTEBRAL SERIES PROBABLY ASSOCIATED WITH FIVE OF THE CRANIA OR JAWS. Compare Table II

Several scattered series of vertebræ have been reassembled according to size which represent five, or at the most six, individuals, numbered as follows: Amer. Mus. 26833*a*, 26833*b*, 26833*c*, 26833*d*, 26833*e*, 26833*f*. Of these, one vertebral series (Amer. Mus. 26833*a*) may with some probability be associated with the type (Amer. Mus. 26820) cranium and jaws; while another series (Amer. Mus. 26833*b*) may be associated with the paratype cranium and jaws (Amer. Mus. 26821).

In the assembling by order of size these vertebral series present the

TABLE II

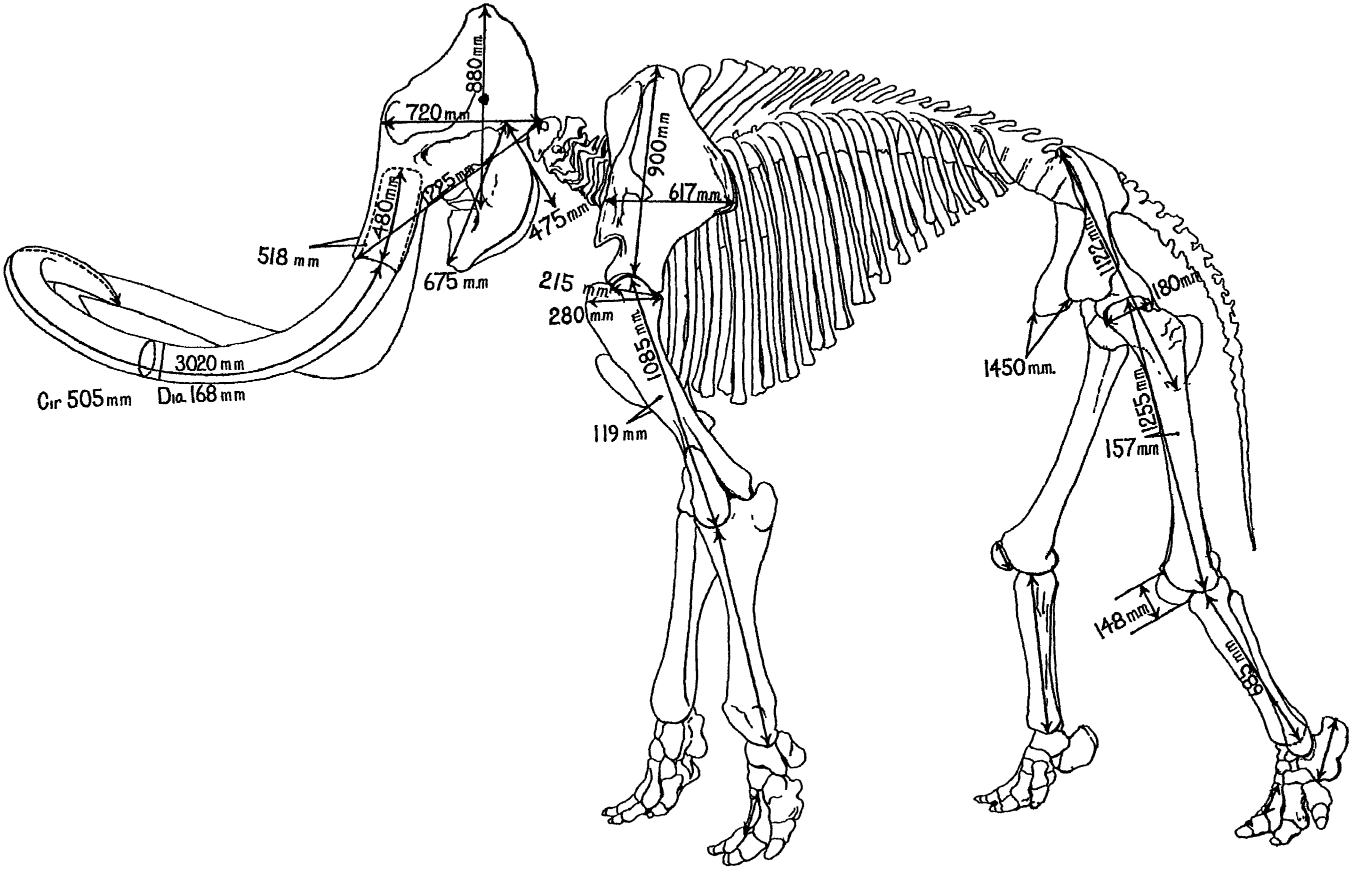
TRANSVERSE DIAMETERS OF VERTEBRAL CENTRA

	Parelephas jeffersonii Amer. Mus. 9950	*Parelephas floridanus* Amer. Mus. 26833*c*	*Parelephas floridanus* Amer. Mus. 26833*a*	*Parelephas floridanus* Amer. Mus. 26833*e*	*Parelephas floridanus* Amer. Mus. 26833*b*	*Parelephas floridanus* Amer. Mus. 26833*d*
Cervical 1	220	225				
2	152					
3	155					
4	153					
5	147		171		199	
6	145		163		197	
7		148				
Dorsal 1						
2						
3	121					
4	132					
5	135				130	
6	133					150
7	124					
8	123					
9	118					
10	116	117				
11	114		117			
12	122	114			127	
13	125		129			
14	122	127				
15	123		135			
16	126	120				
17	126			127	136	
18	125	115	119	126		137
19	127		121			136
Lumbar 1	142	154	127			144
2	150		143			
3	153				175	
4	161					
Sacrals 1–4, length	377	320*e*			320*e*	

following vertical and transverse measurements of the centra:

Amer. Mus. 26833*c*, of the smallest measurement,

Cervicals, including C1 (*tr.* 225×*ver.* 122), C2, C3, C7 (*tr.* 148×*ver.* 150).


880mm
720mm
1295mm
480mm
518 mm
675 mm
475mm
900mm
617mm
215 mm
280mm
1085mm
119 mm
3020 mm
Cir 505mm
Dia. 168 mm
1450mm.
1122mm
180mm
1255mm
157mm
148mm
685 mm

Dorsals, including D6, D10 (*tr.* 117×*ver.* 123), D12 (*tr.* 114×*ver.* 117), D14 (*tr.* 127×*ver.* 113), D16 (*tr.* 120×*ver.* 110), D18 (*tr.* 115×*ver.* 114).
Lumbars, including L1 (*tr.* 154×*ver.* 115), L3, L4.
Sacrals, including sacral 1–4, length 320 mm. *e.*

Amer. Mus. 26833*a*, probably associated with type (Amer. Mus. 26820).
Cervicals, including C1, C5 (*tr.* 171×*ver.* 154), C6 (*tr.* 163×*ver.* 156).
Dorsals, including D1, D11 (*tr.* 117×*ver.* 126), D13 (*tr.* 129×*ver.* 116), D15 (*tr.* 135×*ver.* 118), D18 (*tr.* 119×*ver.* 122), D19 (*tr.* 121×*ver.* 122).
Lumbars, including L1 (*tr.* 127×*ver.* 118), L2 (*tr.* 143×*ver.* 116).

Amer. Mus. 26833*e*, including a few dorsals of larger measurement, namely, D17 (*tr.* 127×*ver.* 128), D18 (*tr.* 126×*ver.* 127), D19.

Amer. Mus. 26833*b*, probably associated with large aged paratype (Amer. Mus. 26821).
Cervicals, including C1, C2, C3, C4, C5 (*tr.* 199×*ver.* 181), C6 (*tr.* 197×*ver.* 182).
Dorsals, D4, D5 (*tr.* 130×*ver.* 156), D6, D7, D8, D9, D11, D12 (*tr.* 127×*ver.* 119), D14, D15, D16, D17 (*tr.* 136×*ver.* 131).
Lumbars, L2, L3, (*tr.* 175×*ver.* 128).
Sacrals 1–4, length 320 mm. +.

Amer. Mus. 26833*d*, including four vertebræ of the largest measurement, namely:
Dorsals, D6 (*tr.* 150×*ver.* 165), D18 (*tr.* 137×*ver.* 135), D19 (*tr.* 136×*ver.* 139).
Lumbars, L1 (*tr.* 144×*ver.* 136).

Comparison with *Parelephas jeffersonii* type (Amer. Mus. 9950); transverse measurements of centra. See Table II.
C1 (*tr.* 220), C2 (*tr.* 152), C3 (*tr.* 155), C4 (*tr.* 153), C5 (*tr.* 147); C6 (*tr.* 145), C7.
Dorsals, D1, D2, D3 (*tr.* 121), D4 (*tr.* 132), D5 (*tr.* 135), D6 (*tr.* 133), D7 (*tr.* 124), D8 (*tr.* 123), D9 (*tr.* 118), D10 (*tr.* 116), D11 (*tr.* 114), D12 (*tr.* 122), D13 (*tr.* 125), D14 (*tr.* 122), D15 (*tr.* 123), D16 (*tr.* 126), D17 (*tr.* 126), D18 (*tr.* 125), D19 (*tr.* 127).
Lumbars, L1 (*tr.* 142), L2 (*tr.* 150), L3 (*tr.* 153), L4 (*tr.* 161).
Sacrals 1–4, length 377 mm.

The transverse measurements of the type (Amer. Mus. 9950) of *P. jeffersonii* in general agree most closely with the smallest *P. floridanus* (Amer. Mus. 26833*c*), omitting C7, D1 and D2 which could not be obtained. In the linear measurement of the sacrals 1–4, *P. jeffersonii* (377 mm.) exceeds the smaller *P. floridanus* (320 mm. *e*). Very significant are the steadily increasing transverse diameters in the posterior dorso-lumbar vertebræ of *P. jeffersonii* D3 (*tr.* 121) Lumbar 4 (*tr.* 161). The anterior dorsals are wide transversely; in the middle region of the back the vertebræ become quite narrow, and near the lumbar series they become wider; this rule was also found to hold with *Elephas indicus.*

Whereas, as appears in Table II, the transverse measurements of *P. jeffersonii* are fairly constant, similar transverse measurements of *P. floridanus* display great irregularity, owing to irregular disposition or distortion and to possible errors in our assemblage.

TABLE III

Comparative Skeletal Measurements of Two Individuals of *Parelephas floridanus* Compared with *P. jeffersonii*

	Parelephas jeffersonii Type A. M. 9950 Skeleton	*Parelephas floridanus* Type A. M. 26820 Skull and ref. limb-bones Male—mid. aged.	*P. floridanus* Paratype. A. M. 26821 Skull and ref. limb-bones. Male—aged.
Cranium—occip. condyle to mid-symphysis	980	1102	
occip. condyle to ant. orbit	720	770*e*	
trans. premaxillary	518	575	
bathycephaly	880	1000*e*	
Jaw—condyle to mid-symphysis	675	725	750
height or depth, condyle to lower border	475	535	560
Scapula—height, supra-scap. border to glenoid. R	905		
ant.-post. glenoid borders. R.	220		
height, supra-scap. border to glenoid. L.	900		
ant.-post. glenoid borders. L.	215+	230	
ant.-post. diameter through metacromion. R.	622		
ant.-post. diameter through metacromion. L.	617		
Humerus—articular length. R.	1120	1140	
mid-diameter, ant.-post. R.	109+	130	
ant.-post. diameter of head. R.	279	255	
articular length. L.	1085+	1143	1185
mid-diameter, ant.-post. L.	119	120	128
ant.-post. diameter of head. L.	280	260	267
Radius—articular length	Rest.		
Ulna—articular length. R.	Rest.	750±	
articular length. L.	Rest.		
Manus—metacarpal III—articular length. R.	Rest.		
metacarpal III—articular length. L.	Rest.	208	
Pelvis—length of os innominatum	1122		
transverse diameter of ilia	1450		
max. diameter of acetabulum	180	183	
Femur—articular length. R.	1250±	1230	
mid-diameter, transverse. R.	155	144	
articular length. L.	1255		1393
mid-diameter, transverse. L.	157		154
Patella—diameter. R.	148		
diameter. L.	Rest.	151	160
Tibia—articular length. R.	690	698	
articular length. L.	685	685	
Calcaneum—length. R.	Rest.	231	
breadth. R.	Rest.	177	
length. L.	Rest.	232	
breadth. L.	Rest.	178	
Metatarsal III—articular length. R.	Rest.	155	
articular length. L.	Rest.		

CONCLUSIONS

The giant *Parelephas floridanus* is a most welcome new stage or ascending mutation in the long history of *Parelephas* migration which may now be traced back to the Lower Pleistocene or possibly the Upper Pliocene and western Europe.

It is not improbable that certain of the specimens found in Florida which hitherto have been referred to *Parelephas columbi* with its limited ridge formula, M 3 $\frac{19}{16+}$, actually belong nearer to *P. floridanus* stage with its more progressive ridge formula, M 3 $\frac{2\,2+}{2\,1+}$. The three specimens in the National Museum, N. M. 11810, an r.M^3 exhibiting +19 ridge plates; N. M. 11808, a fractured third superior molar exhibiting +13 ridge plates; and N. M. 11806, an l.M^2 exhibiting +12 ridge plates, appear to be nearer *Parelephas floridanus* rather than to the typical *P. columbi*, to which they were first referred by Osborn.

R. M.^{3}			
	Length	+258	mm.
(N. M. 11810)	Width, maximum	90	mm.
	Height at 13th r. p.	167+	mm.
	Height at 17th r. p.	159	mm.
Two to three anterior plates missing.	Number of ridge plates	+19	
	Ridge plates per 10 cm.	7	
R. M.^{3}			
	Length	+200	mm.
(N M. 11808)	Width at ?8th r. p.	89	mm.
	Height of ?13th r p.	195	mm
Seven to eight anterior ridge plates missing.	Number of ridge plates	+13	
	Ridge plates per 10 cm.	7	

In the typical *Parelephas floridanus* the eight posterior ridge crest foldings collectively measure 1309 mm. in height. In N. M. 11808 the corresponding eight ridge crests (13–20) measure 1196 mm. In the neotype of *Parelephas columbi* the ridge crests (12–19) measure 1117 mm. Thus N. M. 11808 and N. M. 11810 are intermediate in the collective height of their eight posterior ridge crests between the paratype of *Parelephas floridanus* and the neotype of *Parelephas columbi*. In brief, M^3 is much taller or more hypsodont in *P. floridanus* than in *P. columbi;* the National Museum specimens are intermediate but tend toward *P. floridanus*.

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FISHES WITH TWO MOUTHS

By E. W. Gudger

INTRODUCTION

Malformations of the mouths of fishes, while rather unusual, are not unknown. These range from pug-headedness (in which, because of the absence of the upper jaw, the open buccal cavity looks like the entrance to a cave) through partial to complete buccal occlusion. In the latter case feeding as well as breathing takes place through the branchial apertures. However, probably the rarest of all mouth malformations is that in which two functional mouths are present. Four cases of this are recorded in the literature, and a specimen (a fifth case) of such a fish lies before me. Under the circumstances it seems well to describe the fish and to bring together the accounts in the literature as a background.

A TWO-MOUTHED YELLOW PERCH, *PERCA FLAVESCENS*

The Erie (Pennsylvania) Public Museum issues a popular little journal called The Broadcaster to keep its members and friends in touch with its activities. My attention was recently called to a statement in the issue of June 1, 1930, that the Museum possessed a perch having two mouths. A letter to the Director, Mrs. Katharine B. Blake, brought the fish and all the available information about it. It is a pleasure to acknowledge this courteous response to my request for the loan of this unusual specimen.

This fish, hooked in the lower mouth, was taken on July 2, 1914, from the pier of the Life Saving Station situated on Presque Isle, at the mouth of Erie Harbor, Lake Erie.

This specimen is a fresh-water perch, *Perca flavescens*, measuring 174 mm. in total and 146 in standard length. It has been eviscerated and after long immersion in alcohol has a girth of 95 mm. and a weight of only 23.5 grams. The vertical gape of the mouth proper is 13 mm., the horizontal stretch across the mouth from angle to angle is 11 mm. The second mouth (?) has a vertical gape of 22 mm. and a horizontal stretch of 11 mm. Both these mouths open into the gullet.

The fish is shown in lateral view slightly reduced (to 120 mm. over all) in Fig. 1. Here one sees the morphological mouth as an entirely normal structure, while below it is the enormous opening, the second mouth. In Fig. 2 are portrayed the mouth-parts in anterior view, and in Fig. 3 the same in oblique (quartering) view. In both these figures one sees how much larger the lower mouth is than the upper and true one. In this lower mouth may be seen the tongue bone and the attached gill-arches.

The fish then has two functional mouths. Inspection of these showed that apparently a certain amount of functional activity of the upper jaw was possible, but that the lower part of the second mouth was immovably fixed. Prehension then could be effected only by the closure of the jaws of the morphological mouth, but undoubtedly food could also enter by the lower opening—drawn in by the sucking action of the opening gill-covers. One cannot say if there was at the same time any movement of the floor of the second mouth to help ingestion. This seems doubtful. That the lower mouth is functional for feeding is clear when it is remembered that the fish was hooked in this opening.

The explanation of this curious lower structure is not far to seek. The whole floor of the mouth, the hyoid region, has been torn away from the jaws and by contraction of the branchial muscles has been pulled backward and downward into the present position. In fact the sheet of tissue lying between the jaws and the hyoid apparatus has been drawn backward around the projecting central gill-arch apparatus in a cloak-like fold (Fig. 1). Healing has taken place perfectly, and there is no sign of infection or sloughing of the tissues.

At the time this interesting specimen came to me, there was in the literature known to me but one account of such a deformity. However, since then three other accounts have been found. These will now be taken up in chronological order, that all the known accounts may be brought together and considered here.

A BIB OR POUT, *GADUS LUSCUS*, WITH TWO MOUTHS

My interest in fishes with two mouths was first aroused by the picture and description of the fish shown in Fig. 4. This was sent to me by Mr. R. L. Marston, editor of the Fishing Gazette (London), for whose courtesy I am greatly obliged. The account itself is a brief one contributed by Mr. Percy Wadham (1926), the well known sportsman of the Isle of Wight. He says:

> Unfortunately, I did not see it in the flesh, but it appears in the photograph as though the lower mouth is properly formed with teeth and tongue complete, and I understand it was hooked in the lower jaw by an angler fishing off Cowes, I. W. . . .

I do not know the weight of the fish, . . . but doubt if it was much over half a pound, as this species runs pretty small in the Solent.

Inspection of Fig. 4, in which the head is in sharp focus, shows, here, a precisely similar state of affairs as that described for the yellow perch above. The whole hyoid with the attached parts has been torn from the lower jaw, and there has thus been formed a gaping functional lower mouth. What Mr. Wadham took for jaws and teeth are the gill-arches and gill-rakers, and for the tongue, the basihyal. The true mouth can be closed, but this lower mouth gapes continually.

A TWO-MOUTHED TROUT (*SALMO FARIO?*)

The only specimen of a two-mouthed fish known in the literature at the time when the Erie specimen came to me refers to such a deformed "laxoring" (trout) described by Lönnberg, in 1917.

Lönnberg does not give the size of his fish, which he did not collect himself, and of which the head only came to him. The fish was taken by hook and line in July, 1916, in Storum, Sweden. He remarks upon the significance of the fact that it was hooked in the lower mouth as indicative of the fact that the fish fed through this abnormal mouth. He notes that the lower jaw of the real mouth is entirely normal and that the edges of the tissues on the lower side of the jaw and on the free edges of the hyoid parts are as sharply defined as if they had been cut with a knife. He thinks that this injury must have been inflicted long before the specimen came to him because of the absence of any scar tissue or sign of mechanical injury, but much more because the inner edges of the skin, the tongue and the anterior parts of the attached gill-arches are "strongly pigmented." This, of course, indicates that these parts had been long exposed to the light. Evidently this fish went about with its lower "mouth" open and exposed to the sun's rays. No such pigmentation was found in the true mouth which was evidently normally more or less closed. None was visible in the second mouth of the Erie specimen, as may be seen by reference to Fig. 2. However, had there ever been such, it would have been bleached out during the long sojourn (sixteen years) of the fish in alcohol.

With regard to the formation of this secondary aperture, Lönnberg thinks the edges too smooth and the parts too symmetrical to have resulted from a tear by a hook caught in the outer throat-parts. He is inclined to believe that some slight mechanical injury to the tissues between the jaw and the first gill-arch may have been accentuated by the prehension of prey resulting in a further tearing of the membrane and displacement of the hyoid parts.

Lönnberg published an excellent figure (Fig. 5 herein), in which the lower mouth (indicated by the arrow) is of enormous size due to the tremendous downward displacement of the hyoid parts. The floor of this second mouth is quite densely pigmented as recorded.

A GRAYLING, *THYMALLUS VULGARIS*, WITH TWO MOUTHS

The interest excited by Lönnberg's article led to the republication on the pages immediately following it in the Swedish journal of a forgotten note on the same subject by Ivar Arwidsson (1909, 1917). This had appeared eight years previously in the same journal, but as the title had never gotten into any known bibliography, it had been completely overlooked. In the literature cited at the end of this paper it is listed from both issues of the journal.

The head of Arwidsson's specimen is shown herein as Fig. 6. It portrays an exactly similar malformation of the lower jaw as have the other fishes. Here, also, the hyoid apparatus had been detached from the lower jaw, but the tissues had healed perfectly and the new mouth was entirely bilateral. The author had no conjecture to make as to the origin of the injury. The fish was taken in a net in Jämtland, Sweden, in September, 1907. Arwidsson significantly notes that it was a lean fish and concludes that this was a consequence of starvation brought about by the injury it had suffered.

In Fig. 7 this head is shown in front-ventral view. Printed very dark on soft paper this figure has necessarily been poorly reproduced, but it is included that an idea may be had of the size and shape of the aperture left by the violent dislocation of the floor of the mouth.

AN ANGLER, *LOPHIUS PISCATORIUS*, WITH A SUPPLEMENTARY MOUTH

The sole remaining account, and the earliest known to me, dates back to 1810. In this year, A. Risso published his first book on the fishes of Nice, and in this he describes a "baudroie," the European angler, in the following terms:

> A monstrous specimen of this species, taken in March, 1806, at Villefranche, had an enormous head but one with two very large mouths placed one above and the other below. Both were provided with five rows of sharp teeth. They were united behind in a throat bristling with teeth. The two throats belong to one and the same body.

The same description in almost the same words is given in Risso's larger work published sixteen years later (1826) in five volumes. Too much credit cannot be given Risso for this observation, which is but one of many keen natural-history notes on the many interesting things about the structures and habits of fishes to be found in his book.

That he was in error does not militate against the above statement. There is every reason to believe that this fish had suffered the identical injury described above, that the whole hyoid apparatus had suffered dislocation, and that the five rows of sharp teeth in the lower mouth were really the pharyngeal teeth showing in this lower mouth by reason of the downward dislocation of the whole pharyngeal region. It is greatly to be regretted that Risso did not publish a figure showing this extraordinary teratological specimen.

DOUBLE MONSTER FISH EMBRYOS WITH TWO MOUTHS PLACED LATERALLY

Other than the foregoing, the only two-mouthed fishes known to me are two embryo trouts figured by Gemmill in his great work on malformations in fishes. Furthermore, these are not vertical duplications but lateral ones. These are double monsters with complete union in the head region. In one, the two inner eyes are placed close to each other, and there are "two mouth openings separated by a thick septum containing the adjacent hyomandibular and Meckelian cartilages. . . . The two mouth-openings lead into separate buccal cavities but the oesophagus is single." This specimen is shown in outline drawing in Fig. 8. Gemmill also figures an embryo trout having three eyes: two normal lateral eyes and one intermediate one formed probably by the fusion of the two inner eyes or consisting of the one left following the suppression of the other inner eye. The head of this fish is shown in outline drawing in Fig. 9. Here the two lateral mouths are seen much closer than in the preceding specimen but still separated by the remains of the Meckelian bars.

These figures and descriptions are of fishes having duplicate mouths laterally placed. They add little to our knowledge, for such malformed embryos never survive the end of yolk-sac absorption. Strictly speaking, these two embryos are hardly pertinent to the subject under discussion, but these two paragraphs are introduced to emphasize the fact that there are no records whatever of fishes with two mouths other than those shown herein to be the result of injury rather than of deficiencies arising during development.

RÉSUMÉ

Inspection of the figures of the first four fishes described shows the same identical condition: the hyoid apparatus with attached gill-bars has been forcibly torn away from the mandibles and remains displaced at some distance from the lower jaw. This gives a functional lower mouth, but one which remains permanently open since it lacks any muscles which would bring it in opposition to the lower and inner edges of the mandibles. One can conceive that such a fish swimming along might automatically engulf quiescent organisms or bits of dead food. Certainly there can be no prehension by this lower mouth, and in fact any food prehended by the upper and lower jaws would, since there is no tongue to work with the jaws, fall into the enlarged buccal cavity and, if active, swim away. Presumably, such a deformed fish must feed mainly by sucking in food by the action of its gill covers.

In this connection it should be noted that three out of the five fishes described were taken on a hook—it is definitely stated that each was hooked in the lower mouth. This would seem to show that this aperture is the one most used in feeding.

This second mouth must be the result of some injury or accident, presumably in adult life, certainly long since hatching.

Whether in a teleost a second and lower morphological mouth could be formed in the embryo is a matter of great doubt. Lateral horizontal duplications in bony fishes are not unknown, as double heads and twin tails (and even mouths in embryos, as shown above) bear witness. But, so far as I know, no dorsiventral doubling of parts is on record. According to Dohrn's theory of the formation of the mouth out of pre-mandibular gill-clefts by coalescence, it seems hard to understand how a second and lower mouth could be formed save by using up a second pair of gill-clefts. There is no evidence that such has taken place in the specimens under consideration. None are lacking in the perch (Fig. 2) and the loose tissue connecting the branchial basket with the lower jaw has curled back and lies blanket-like around the basihyal. Apparently, essentially similar conditions are met with in the other fishes figured and described. Double mouths in fishes are always the result of injury, so far as our present knowledge goes.

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Fig. 1. Lateral view of a 174 mm. yellow perch, *Perca flavescens*, showing two mouths.

Fig. 2. Looking into the two mouths of *Perca flavescens*. Note the gill-arches in the floor of the second mouth.

Fig. 3. Slightly oblique view of the two mouths of the yellow perch.

Fig. 4. Quartering view of a bib (*Gadus luscus*) with two mouths.

After Wadham, 1926.

Fig. 5. An almost lateral view of the head of a trout with two mouths. The arrow points to the second mouth.

After Lonnberg, 1917.

Fig. 6. Profile view of a grayling (*Thymallus vulgaris*) with two mouths.

After Arwidsson, 1909 and 1917.

Fig. 7. Head of grayling seen in front-ventral aspect.

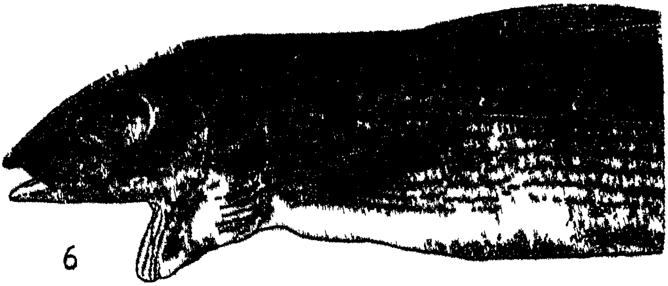
After Arwidsson, 1909 and 1917.

Fig. 8. Double-monster trout embryo having two mouths separated by a wide septum.

After Gemmill, 1912.

Fig. 9. Double monster trout embryo having two mouths separated by a narrow septum. In this fish the fusion is more complete and the embryo less abnormal in general appearance.

After Gemmill, 1912.



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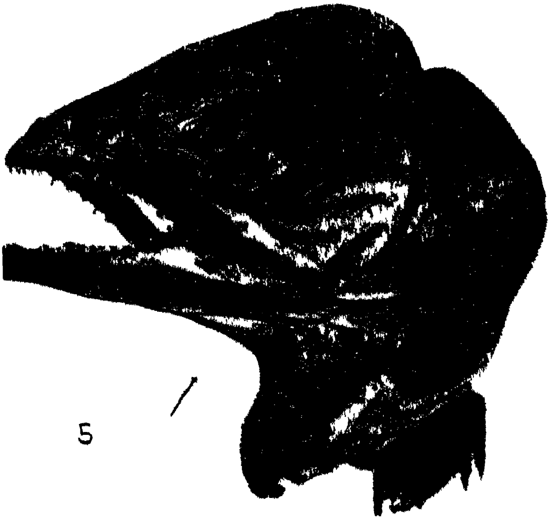

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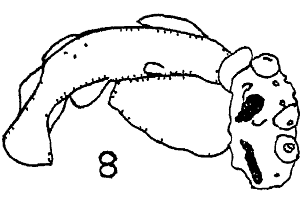

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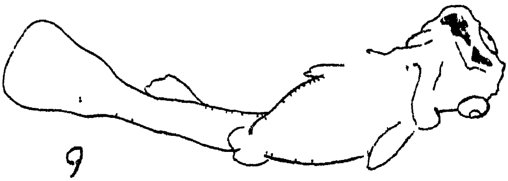

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ALLOGNATHOSUCHUS MOOKI, A NEW CROCODILE FROM THE PUERCO FORMATION

BY GEORGE GAYLORD SIMPSON

One of the principal discoveries of the 1929 expedition of the American Museum of Natural History to the San Juan Basin, New Mexico, was the nearly complete skeleton of a crocodile. The specimen is interesting morphologically because it reveals the complete osteology in a peculiar phylum hitherto known only from fragments; faunally, because it is the first good and really identifiable crocodile material from the Paleocene; stratigraphically, because it adds an important example to the very few lines that do or may give some conception of actual evolutionary advance in the Cretaceous-Tertiary transition; and ecologically, because it is a peculiar adaptive type hitherto misinterpreted.

Complete description of the specimen, not yet fully disarticulated and cleaned, falls within the province of Mook's monographic studies on the living and extinct Crocodilia, now in progress, and the present notice will be followed by his more detailed morphological account.

TAXONOMY

No crocodiles from the Paleocene have hitherto been named or identified. *Crocodilus staveliamus* Cope, 1885, is generally given as from the Puerco, but the original description clearly states that the type was associated with dinosaurs and came from the "Laramie." It is indeterminate, furthermore, and the single type tooth does not agree with any in the present specimen.

Gilmore (1920) noted the presence of crocodiles in the Puerco and Torrejon, but stated that his material was indeterminate. Mook (1921A) said that teeth like those of *Allognathosuchus heterodon* (a Wasatch species) occur in the Puerco and that this genus might be present in the Paleocene. The existence of Paleocene crocodiles has long been known, but their morphology and affinities are almost completely unknown or unpublished.

The present specimen belongs in the genus *Allognathosuchus*, as will be made clear below. It is placed in a new species named in recognition

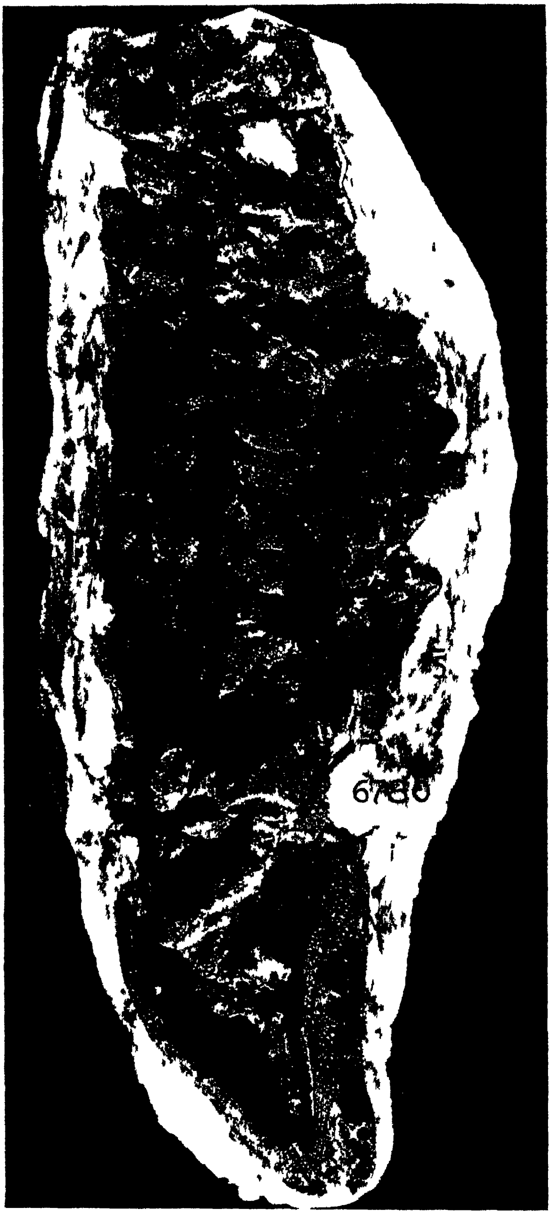

Fig. 1. *Allognathosuchus mooki*, n sp. Type, Amer Mus 6780. Skull and part of skeleton showing scutes Inferior view One-fifth natural size

of Dr. C. C. Mook's extensive work on Crocodilia and first distinction of the genus of which this becomes the most complete representative.

Allognathosuchus mooki, new species

TYPE.—Amer. Mus. No. 6780, skull, jaws, and most of skeleton. Coll. G. G. Simpson, 1929.

HORIZON AND LOCALITY.—Upper fossil level ("*Tæniolabis* zone"), Puerco Formation, Barrel Spring Arroyo, San Juan Basin, New Mexico.

DIAGNOSIS.—The earliest known species of *Allognathosuchus*. Size relatively large, skull somewhat more elongate, less distinctly triangular than in *A. heterodon.* Five premaxillary, fourteen maxillary, and twenty mandibular teeth. Third and fourth maxillary and fourth and thirteenth mandibular teeth much enlarged, conical. Third maxillary teeth larger than in *A. heterodon;* posterior upper teeth somewhat less enlarged and bulbous. Lower jaw very stout, dental border depressed and flattened, symphysis deeper than in *A. polyodon,* surangular rising less abruptly posterior to teeth, alveoli separated by stouter, more complete walls.

The diagnosis of species is difficult, as the genus is not much varied and the later species are poorly known. The specific characters of *A. polyodon* and *A. heterodon* as given by Mook (1921A) are for the most part generic and not specific, or at least appear, so far as known, in both of these species, in *A. mooki,* and probably also in *A. wartheni.* The discrepancies in the description of the latter (Case, 1925) are that the thirteenth to fifteenth mandibular teeth (by our count) are said to be equal and that there would apparently be two less posterior lower teeth. From Case's figures and text no greater difference than this can apparently be postulated, and the material is so fragmentary that the reality of these distinctions is not wholly clear. The specific status may well be granted on Case's authority, however, and it seems that *A. wartheni* cannot be compared with *A. mooki* as closely as can its contemporary *A. heterodon.*

The generic characters may be briefly emended as follows:

Allognathosuchus Mook, 1921

TYPE.—*A. polyodon* (Cope, 1873).

REFERRED SPECIES.—*A. heterodon* (Cope, 1872); *A. wartheni* Case, 1925; *A. mooki* Simpson, 1930.

DISTRIBUTION.—*A. polyodon,* Bridger, Wyoming. *A. heterodon* and *A. wartheni,* Wasatch, Wyoming. *A. mooki,* Puerco, New Mexico.

DIAGNOSIS.—Crocodilidæ of small to medium size. Skulls short and broad, snout short, blunt. Nasals entering but not dividing external nares. Internal nares relatively anterior. Supratemporal fenestræ about half as large as orbits, relatively close together. Symphysis short, but including splenials. Postdental part of lower jaw longer than dental. Upper border of lower jaw wavy, rising anteriorly, in the vicinity of the thirteenth tooth, and posterior to the teeth, and concave between these elevations. Bite alligator-like, the anterior lower teeth occluding altogether internal to the upper teeth and to the edge of the palate, the posterior lower teeth partly internal and partly opposed to the uppers. Dentition differentiated into anterior conical teeth and posterior blunt, globose, low-crowned teeth. Two much enlarged conical teeth in lower jaw (often or always the fourth and thirteenth) separated by a series of very small subspatulate or conical teeth. One or two much enlarged conical teeth in upper jaw (fourth or third and fourth maxillary teeth).

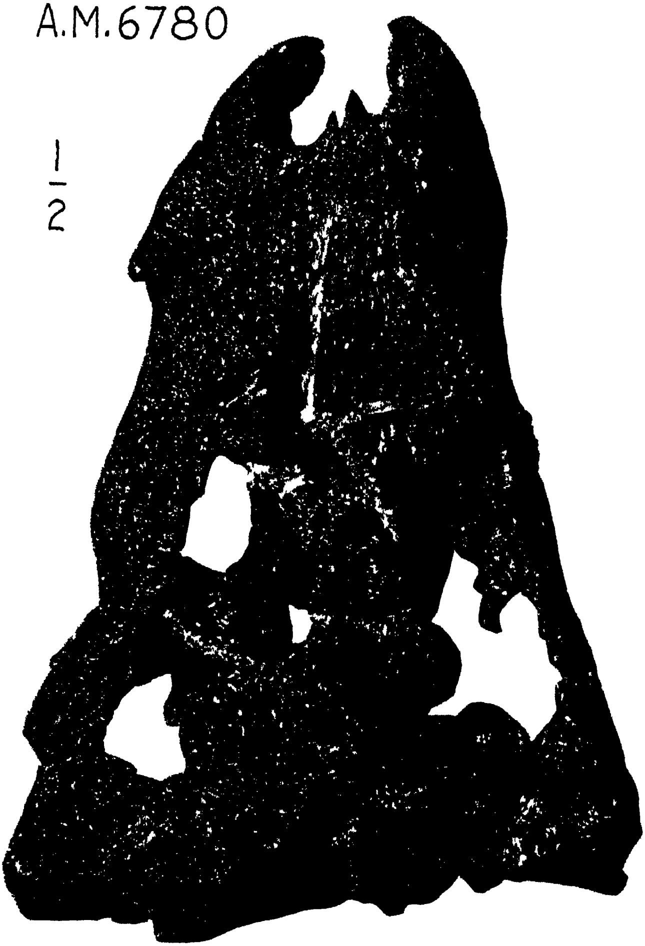

Fig. 2. *Allognathosuchus mooki*, n. sp. Type, Amer. Mus. 6780. Skull, superior view, one-half natural size.

MORPHOLOGY

Complete morphological description by Dr. Mook will follow. The present section is confined to brief notes on certain features of interest in the skull, jaws, and dentition.

SKULL.—The general form of the skull is alligatoroid, the outline most nearly resembling *Jacare niger* among recent crocodilians. The contour of the blunt snout is broken by swellings for the large third and fourth maxillary teeth and by shallow notches posterior to these. The snout is depressed, with no preorbital crests or elevations, and the braincase rises moderately above it. The total length of the skull is about 235 mm., the preorbital length about 117 mm., and the maximum preorbital width 110–115 mm., as nearly as measurable on the crushed specimen.

The orbits are about 55 mm. in diameter and are open into the infratemporal fenestræ. The interorbital region and cranial table are but slightly concave. The supraorbital fenestræ were about 30 mm. in diameter, the outer bars about 17 mm., and the middle bar about 15 mm.

The external nares are at the tip of the snout, the anterior processes of the premaxillæ being narrow and but slightly reflected back over the nares. The nares are undivided, but the tips of the nasals project into them. The nasals are long, lanceolate together, and extend nearly to the level of the orbits. The frontals were not inserted between them.

The palatines extend well forward of the posterior palatal vacuities, and their anterior parts are distinctly wider than between the vacuities. The internal nares are removed about 13.5 mm. from the vertical posterior pterygoid-basisphenoid plate—a remarkably anterior position.

These and other osteological characters of the skull seem to be fairly close to the typical primitive true crocodilid condition. The other modifications are of minor significance and mostly related to the unusual proportions: short dental series and long postdental region.

LOWER JAW.—The more important features of the lower jaw have been described by Mook for *A. polyodon*. That of the present species is similar save in detail. The symphysis, deeper than in *A. polyodon*, extends to about the eighth mandibular tooth and includes the splenials for a short distance. The jaw is stouter than in *A. polyodon*. The dental border is flattened and forms a shelf internal to the first thirteen teeth and on both sides of those behind this point. Opposite the last four teeth it forms a sharp flange projecting above the inner surface of the jaw. The rise posterior to the teeth is not as marked in the present species, and its abruptness is exaggerated in Mook's photographs and subsequent restorations of *A. polyodon* because the sloping anterior end of the surangular is broken off in that type specimen. The mandibular foramen, absent in Case's restoration and small in Abel's, is of average size in the present specimen and was apparently similar in *A. polyodon*.

DENTITION.—There are nineteen upper and twenty lower teeth on each side. Five of the upper teeth are in the premaxilla and fourteen in the maxilla.

The crowns of the premaxillary teeth are not preserved. The alveoli are approximately circular and increase in size to the fourth, the first and fifth being about equal. They are closely spaced, but separated by stout, complete walls. At the premaxillo-maxillary suture there is a short diastema of about 6 mm.

The first maxillary alveolus is small. The crowns of the second to fourth teeth are preserved and are of the normal conical, carinate, slightly recurved crocodilian type with faintly wrinkled enamel. The second is small, but the fourth is the largest tooth in the entire dentition, and the third is but little smaller. The next three alveoli, fifth to seventh of the maxilla, are subcircular and with stout, complete partitions. There follows a series of seven teeth more closely crowded, somewhat elongate antero-posteriorly, with the alveolar partitions incomplete toward their mouths. These teeth, eighth to fourteenth of the maxilla, increase in size to the twelfth; the thirteenth

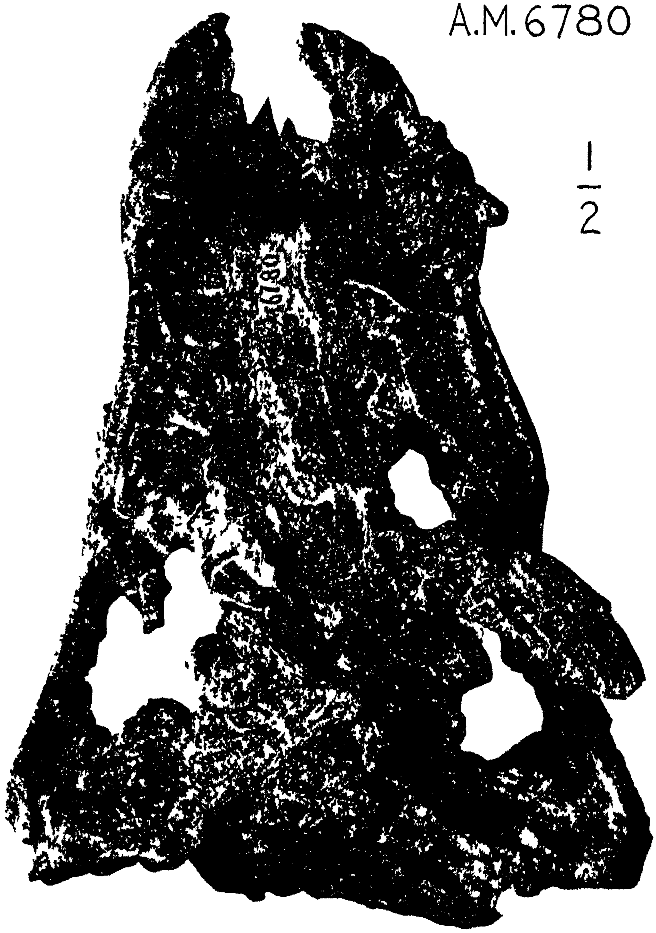

Fig. 3. *Allognathosuchus mooki*, n. sp. Type, Amer. Mus. 6780. Skull, inferior view, one-half natural size.

is slightly and the fourteenth considerably smaller. The crowns of the last three are preserved on one side and are of the *Allognathosuchus* type described by Mook and Case: low, rounded, button-like, with radiating rugosities and an anteroposterior carina but no elevated apex.

The diameters of the alveoli vary somewhat with stage of replacement and are not exactly mensurate, but are about as follows:

Premaxillary: 1- 4 mm.
2- 5
3- 6
4- 9
5- 4
Maxillary: 1- 4
2- 5
3- 9
4-13
5- 5
6- 4
7- 4
8-5
9-6
10-6.5
11-8
12-9
13-9
14-4

The lower dentition begins in front with a moderate-sized conical tooth followed by two others (roots only on the specimen) slightly smaller. The fourth is very large and similar to the fourth maxillary tooth. The teeth in the concavity between this and the next elevation of the dental border cannot be exactly counted on the type, but in another specimen found in 1929 there are eight, which agrees with *A. polyodon.* These are all very small except for the eighth (twelfth of the whole series) which is of moderate size. The crowns of some of these are preserved. They are not depressed, but are subspatulate rather than sharply pointed, with sharp anterior and posterior carinæ, and with the outer side more convex than the inner.

The median elevation in the lower dental series bears the thirteenth tooth, which is large and conical, and the fourteenth, smaller but probably similar. Judging from a Wasatch specimen of *A. heterodon,* the next two alveoli contained teeth transitional in form between the conical and hemispherical types. The last four teeth are preserved and form a depressed, crushing series comparable to the last teeth of the upper jaw. The most anterior preserved has a low but definite apex, while the others are still more flattened.

The large fourth mandibular tooth fits into a deep pit internal to the last premaxillary and first two maxillary teeth, through the bottom of which the suture passes. The thirteenth mandibular tooth fits into a similar but smaller pit internal to the sixth and seventh maxillary teeth. Anterior and posterior to this are very small and poorly defined depressions for the twelfth and fourteenth lower teeth.

Approximate alveolar diameters follow. Those for the fifth to eleventh are from another specimen:

1- 5
2- 4
3- 4
4-11
5-4
6-4
7-3
8-3
9-3
10-3
11-4
12-6
13-8
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20-8

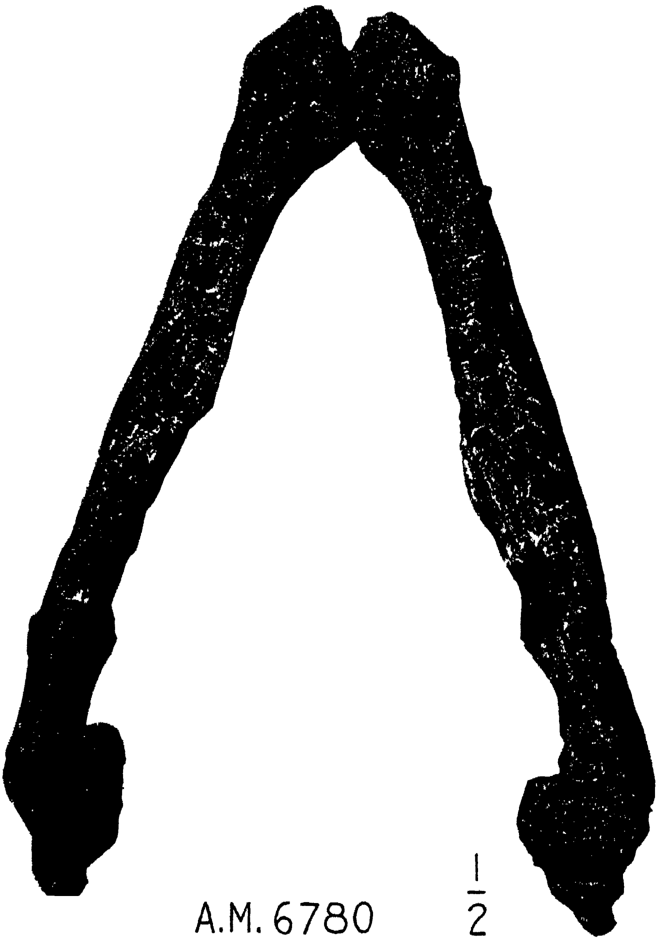

Fig. 4. *Allognathosuchus mooki*, n. sp. Type, Amer. Mus 6780. Jaws, superior view, one-half natural size.

AFFINITIES

It is evident that the present species is referable to *Allognathosuchus*. The differences from *A. heterodon* and *A. wartheni* of the Wasatch and from *A. polyodon* of the Bridger are of specific value, but the four species form a closely delimited group, perhaps a phylum in the most limited sense of the word, although not all of its progressive features can yet be clearly ascertained. They are not very closely comparable to any other known crocodiles.

Further comparisons may exclude Lower Cretaceous or earlier genera and be confined to short-snouted, more or less alligatoroid types. Thus the forms especially to be considered are *Brachychampsa montana* Gilmore of the late Cretaceous, *Caimanoidea*[1] *visheri* Mehl and *C. prenasalis* (Loomis), of the Oligocene, and *Alligator thomsoni* Mook of the Miocene.

Brachychampsa Gilmore, 1911, from the Hell Creek of Montana, is the only known Cretaceous genus with which close comparison is possible. It is known from the front part of the skull. The general proportions are similar to those of *Allognathosuchus*, and so are the general osteological features. Differences are seen in the probably larger facial processes of the premaxillaries, their less reflected anterior borders, the less marked constrictions of the snout, and the much shallower palatal pits. The number of teeth in premaxillæ and maxillæ is the same, but their proportions and forms are not in close agreement. The premaxillary teeth of *Brachychampsa* are more nearly equal in size, and the third is somewhat larger than the fourth. The first five maxillary teeth are subequal, but the fifth, rather than the fourth, is the largest. The following teeth have somewhat the proportions of *Allognathosuchus*. The larger posterior teeth have a special resemblance to those of *Allognathosuchus* but have less depressed crowns. The twelfth maxillary tooth of *Brachychampsa montana*, figured by Gilmore, rather closely resembles the ninth maxillary tooth of *Allognathosuchus heterodon*, for instance, but is larger and has a somewhat higher crown.

Brachychampsa and *Allognathosuchus* trend toward similar adaptive types. The differences are too great and the elapsed time between them too short for possible direct ancestry or very close relationships. The known resemblances are insufficient for final conclusion, but might be interpreted by a tentative hypothesis of rather remote common ancestry. The direct ancestry of *Allognathosuchus* is unknown.

The morphological relationships between *Allognathosuchus* and *Caimanoidea* are unusual. Were *Caimanoidea* the earlier genus, one might suppose it approximately ancestral, for many of its peculiarities resemble those of *Allognathosuchus* but are less extreme. The position and shape of the nares are the same, save that in *Caimanoidea* (as in *Brachychampsa*) the anterior ridges on the premaxillæ are less reflected. The nasals are similar and likewise project into but do not divide the nares. The orbits are closely similar, the supratemporal fenestræ relatively smaller and farther apart. The interorbital and preorbital regions are similarly flat and uncrested. The snout contour is closely similar, with a slight premaxillo-maxillary and pronounced maxillary constriction. The skull is somewhat less triangular in general form than in *A. mooki* and much less than in *A. heterodon*. Most of the other observed osteological characters are the same or similar.

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[1] This name is spelled in three different ways in Mehl's paper (Mehl, 1916); I presume the present spelling was intended.

The lower jaw of *Caimanoidea* differs from that of *Allognathosuchus* in the relatively shorter post-dental portion and less pronounced elevation in the middle of the dental series. It agrees in the most noteworthy feature, the strong participation of the splenial in the symphysis.

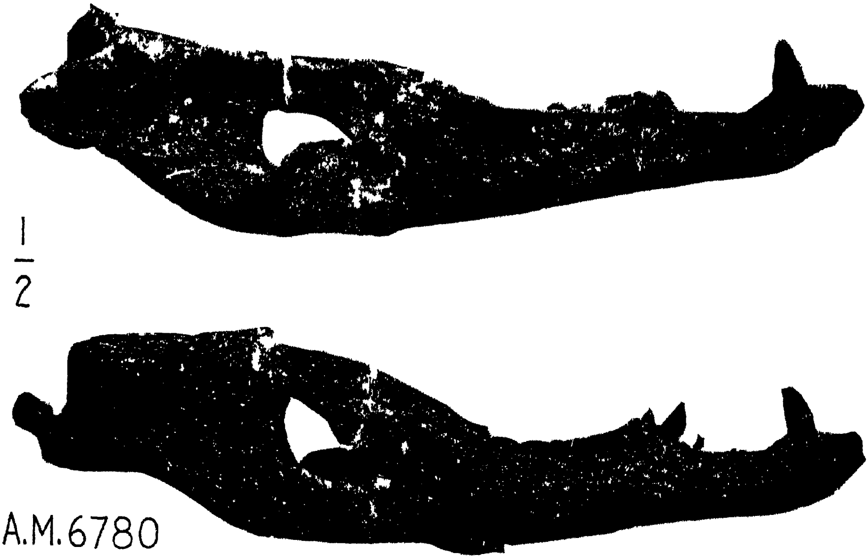

Fig. 5. *Allognathosuchus mooki*, n. sp. Type, Amer. Mus. 6780. Jaws. Upper figure: left ramus, internal view. Lower figure: external view. Both figures one-half natural size.

The dentition likewise has points of important resemblance, but in several respects it seems less specialized in the later genus. The number of maxillary teeth is one less, and so is the number of mandibular teeth. As in *Allognathosuchus*, the fourth premaxillary tooth is the largest of this series and the fourth maxillary tooth is the largest of the whole dentition. Also the anterior teeth are conical and the posterior teeth depressed, with constricted necks and indistinct carinæ. They are not as much flattened as in *Allognathosuchus*, but the difference is not very great and the general proportions are similar. The lower dentition continues the resemblance. The fourth tooth is likewise largest and bites into a deep pit on the premaxillo-maxillary suture. Still, as in *Allognathosuchus*, the first tooth is larger than the subequal second and third. The resemblance even extends to the presence of seven very small teeth in the concavity posterior to the fourth. The median convexity and the large thirteenth tooth are less differentiated, however, and the posterior teeth, like those of the upper jaw, are less extremely depressed.

I do not think it possible to dismiss these resemblances as due entirely to convergence. They are more numerous and more specific than in the case of *Brachychampsa*, for instance. Aside from a few divergent or indifferent characters, however, it is fairly clear that *Caimanoidea* is the more primitive in most of the known parts as such things are usually judged, despite the fact that it is considerably younger than the latest known *Allognathosuchus:* Lower Oligocene as against Middle Eocene. If descended from *Allognathosuchus* it is a case of reversion neither impossible nor unique, but not to be accepted without stronger evidence. Granting the reality of the relationships, a more tenable hypothesis would derive the more specialized and more quickly extinct *Allognathosuchus* line and the rather more conservative and tenacious *Caimanoidea* line from a common ancestry. This common ancestry would be characterized chiefly by the short snout, extremely anterior nares, nasals entering but not separating nares, alligatoroid bite, splenials entering symphysis, about twenty teeth in each jaw, of which the fourth and ninth upper and fourth lower were largest, marked tendency towards tooth differentiation into conical anterior and blunt posterior teeth. Most of these characters may also have been present in ancestral alligators. Some of the true crocodiles of the Eocene do not differ very much from this condition, but were advancing in a different direction and with retention of ancestral features lost in these lines.

Mehl (1916) has suggested that *Caimanoidea* is close to the ancestry of *Caiman*. Mook (1923B) does not mention *Caimanoidea*, but advances the structural sequence *Allognathosuchus heterodon*, *Allog. polyodon*, *Alligator thomsoni*, *Allig. sinense*, *Allig. mississippiensis.* In neither case are these supposed to be direct phyletic lines.

Alligator thomsoni is obviously related to the living species of that genus and particularly to *A. sinense*, as shown by Mook. Relationships to *Caimanoidea* or, still more, to *Allognathosuchus* are speculative at present. The relationship is certainly not direct descent, but it seems

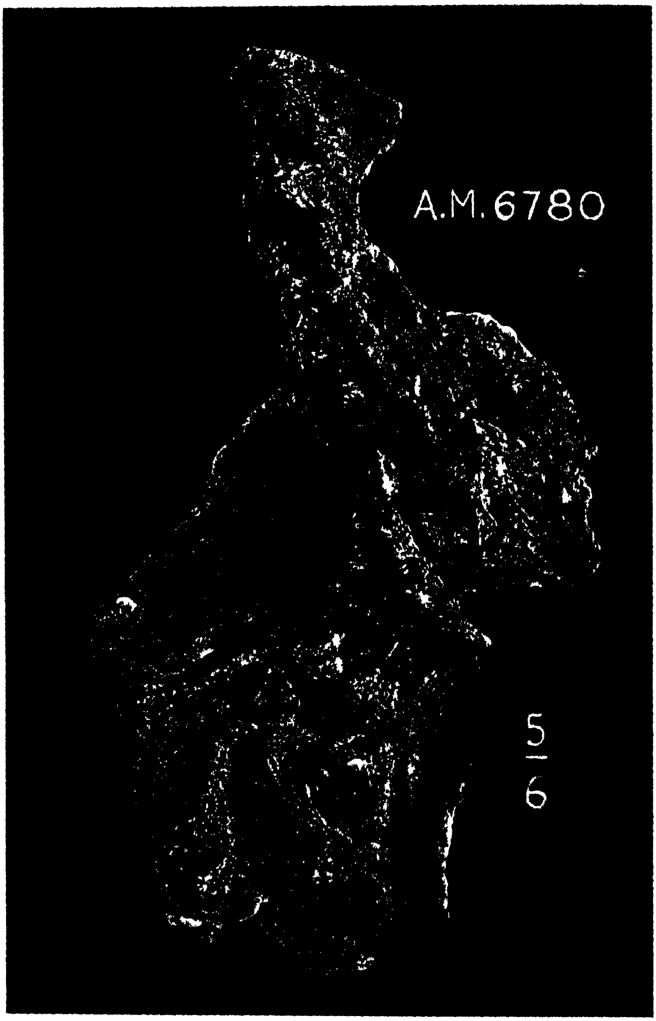

Fig. 6. *Allognathosuchus mooki*, n. sp. Type, Amer. Mus. 6780. Right radius, ulna, carpus, and part of manus, five-sixths natural size.

quite probable that *Caimanoidea* is structurally near the ancestry of *Alligator*, probably nearer than *Allognathosuchus* is to either.

Without prejudicing the results of more detailed study, this preliminary survey suggests the existence in Tertiary times of three alligatoroid offshoots from the crocodile stem type. The first, most divergent and farthest from the true alligators, is exemplified by *Allognathosuchus*. The second, less aberrant and probably significantly closer to the alligators, is seen in *Caimanoidea*. The third includes the alligators, strictly speaking.

Case (1925) proposed a family, Allognathosuchidæ, defined by the shape of the jaw, grouping of the teeth, and presence of low, blunt teeth adapted to a durophagous diet. These are all intensifications in quantity of characters qualitatively present in various true Crocodilidæ. Their accentuation here is hardly of family value. Apropos of the blunter teeth and presumable difference in diet (the chief basis for family distinction), it is well known that these may be of little or no taxonomic value among modern reptiles. The osteology of *Allognathosuchus* has not more than generic distinctiveness.

STRATIGRAPHIC SIGNIFICANCE

Allognathosuchus has some bearing on the great problem of Cretaceous-Tertiary transition (see especially Matthew 1921). The excellence of this specimen will afford future opportunitites for close comparisons with Cretaceous and Eocene species not yet so well known. It belongs to one of the few families that range over the Paleocene from Cretaceous to undoubted Tertiary. It also belongs to the still smaller group of genera surviving from the Lower Paleocene to Middle Eocene.

At present the line of development to which it belongs is unknown in the Lance or earlier beds, but represented in Wasatch and Bridger by very closely related species. This suggests (although far from proving) that it is part of a Puerco immigration surviving far into the Eocene and tends to this extent to link the Paleocene and Eocene, or, rather, to separate the Cretaceous and Paleocene.

Of still greater value would be the discovery in North America of the Cretaceous ancestry of *Allognathosuchus mooki*, for, while it would disprove the preceding tentative conclusion, it might afford an almost unique opportunity to judge the actual evolutionary advance of a single phylum between undoubted Cretaceous, Paleocene, and undoubted Tertiary. At present this ancestry is not recognized, and this negative evidence must be accepted for what it is worth, as suggested in the preceding paragraph.

As an isolated fact, this occurrence has slight value, but it becomes of importance as one more datum to include in future correlations of all the evidence.

PALÆOBIOLOGY

Allognathosuchus presents a peculiar adaptive type. Mook (1921A) stated that "the characters of the skull and jaws [of the Wasatch and Bridger species] indicate an animal of somewhat different adaptations from the normal crocodilians." Case (1925) tasked Mook with undue conservatism and postulated a "durophagous, probably conchifragous diet." Abel (1928) devoted a separate paper to the palæobiology of the genus, concluding that its diet consisted of chelonians, or was "cheloniphage."

Abel's restoration of the lower jaw of *Allognathosuchus polyodon* (the Bridger species) not only goes beyond the evidence of the originals, but also directly contradicts the descriptions on which he was professedly relying. He shows all of the teeth as blunt, and says without qualification that the large teeth of the lower jaw "ebenfalls niedrige, gerundete Kronen aufweisen." This error misses the most interesting adaptive feature of the dentition and vitiates the whole of his extensive argument.

In all species of *Allognathosuchus* the front teeth are conical, of more or less normal crocodilian character, and only the posterior teeth are low and rounded. The most striking feature of this dentition is not the presence of blunt crushing teeth so much as the highly differentiated character of the dentition. In the lower jaw it consists, so to speak, of three pointed "incisors," a large "anterior canine," a series of quite small intermediate teeth, one or two large, pointed "posterior canines," and a series of crushing cheek teeth of different form from those preceding them. Abel's description of the relative sizes of the posterior teeth is also quite incorrect.

Instead of a single anterior "Brechscherenapparat," there is a more complex and mechanically more sound arrangement. The anterior apparatus, itself complex, is primarily a grasping device. Here the jaws move more rapidly (i.e., in a larger arc) and less powerfully. The posterior apparatus, itself simple, is a crushing device. Here the jaws move less rapidly and more powerfully.

Case's belief in a "conchifragous" and Abel's in a "cheloniphagous" diet may both be discarded as based in the one case on incomplete knowledge and in the other on erroneous premises. The primary inferences, those beyond reasonable doubt, are, first, that the jaws are unusually powerful, with large muscles and functioning as levers with relatively short weight arms, and, second, that the dentition served two localized purposes: (1) grasping and tearing, and (2) crushing.

In the attempt to draw further inferences, necessarily increasingly uncertain, the first point is that this adaptation is not as unusual as both Case and Abel imply, and that Mook's conservatism is more to the point than they grant. In the shape of the snout, in the nature of the bite, in the dual differentiation of tooth shape and function, and in the development of blunt posterior teeth, certain of the short-snouted crocodiles and caimans and, to a less degree, even the alligators do approach this type. In *Osteolæmus tetraspis*, for instance, the front teeth are conical, while the back teeth are very close to those of *Allognathosuchus* in form, and in *Jacare niger* conditions are rather similar. In fact, *Allognathosuchus* merely represents the extreme development of an adaptive type still common although in less specialized form. So far as I have been able to learn, these modern forms are not specialized for one particular and unusual type of diet but are among the *least* specific in food habits, eating birds and mammals and otherwise varying the primarily piscine regimen of their allies.

This is the conclusion that might have been drawn from *Allognathosuchus* itself, even without the aid of analogy. The combination of functions in its dentition does not so much imply limitation as versatility. There seems little either in morphology or analogy to suggest a molluscan diet. Nor with a correct understanding of the dentition can it be justly claimed as "cheloniphagous." Chelonians were perhaps included among other food sources, but apparently were not the sole or principal prey.

Even with the correct data now available, it would be temerarious to push inference farther, but a frankly hypothetical suggestion is possible. As long ago as 1879, Owen suggested a correlation between short- and broad-snouted crocodiles and the rise of mammals. *Allognathosuchus* was a preëminently short-snouted genus, and its rise contemporaneously with the first great expansion of varied and fairly large mammals may not have been wholly fortuitous.[1]

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[1] Kellogg's recent study of the food of alligators (U. S. Dept. Agriculture, Technical Bulletin No. 147, 1929) shows mammals as constituting less than 6 per cent. of this food. Birds, reptiles, fishes, insects, and crustaceans each seem as important as mammals in the crocodile diet. A more varied source of data would doubtless alter the exact figures, but it is clear that alligator food habits are highly varied. These concrete observations seem of more value in considering the somewhat analogous *Allognathosuchus* than any amount of theorizing from tooth form to a specific item of diet.

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AMERICAN MUSEUM NOVITATES

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56.81, 7A (115:76.4)

ON A NEW PRIMITIVE THEROMORPH (*EUMATTHEVIA BOLLI*)

BY R. BROOM, F.R.S.

A few months ago, on looking over some of the old specimens in the Cope collection of Permian Reptiles in the American Museum, I came across the remains of a new Theromorph which had been overlooked through the fragmentary skeleton having been wrongly labeled by the collector as that of a small Labyrinthodont.

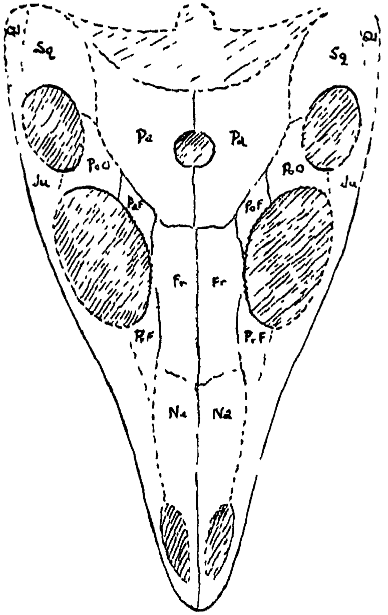

Fig. 1. *Eumatthevia bolli*, n. sp. Type. Skull. Amer. Mus. Cope Coll. 7002. Natural size. Superior view.

The remains are the greater part of a small skeleton considerably crushed and much broken. Among the remains are most of the skull, the greater part of both scapulæ, parts of the anterior limbs, a small part of the pelvis and much of one hind-limb with probably most of the vertebræ. Mixed with the remains of the skeleton are parts of the skeleton of a smaller animal which are not well enough preserved to be determinable.

The specimen [Am. Cope Coll. 7002] was collected in 1880 by Cope's collector Jacob Boll, at Copper Shept, apparently in Texas.

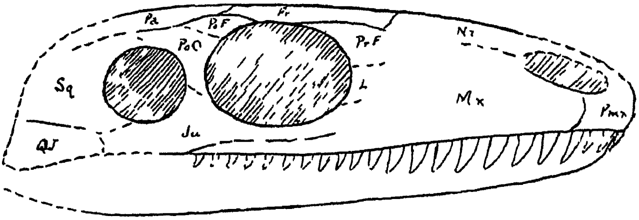

Fig. 2. *Eumatthevia bolli*, n. sp. Type. Skull Amer Mus. Cope Coll. 7002. Natural size. Lateral view, right side.

The sutures in line are those seen in the specimen; those in broken lines are hypothetical but probably correct.

The skull though nearly complete is very badly fractured longitudinally. One slab shows the inner side of the left parietal, frontal and much of the nasals, prefrontal and postorbital bones sufficiently well preserved to enable one to make quite a satisfactory restoration of the top of the skull. A part of the counter slab shows the inner side of the left half of the skull, including practicably a complete lower jaw, with the left orbit and the left temporal fossa. The left squamosal is sufficiently well preserved to make out clearly its size and position, and the left postorbital is nearly perfect. The side view I give of the skull is slightly restored from the bones as seen on the inner aspect. The lower jaw shows almost all the bones of the inner side and can be satisfactorily restored as I have done in figure 3.

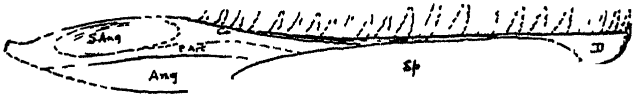

Fig 3. *Eumatthevia bolli*, n. sp. Type. Left ramus of mandible. Amer. Mus. Cope Coll. 7002. Natural size. Internal view.

Another considerable fragment shows the right side of the snout with the premaxilla and much of the maxilla, and under the inner side much of the prevomers.

The premaxillary bone has four sharp, pointed teeth and the maxillary has eighteen. These teeth are typical thecodont teeth, and are as shown in the drawing. The prevomers are long and slender and have a longitudinal row of small teeth. The palatines are not satisfactorily displayed, but the pterygoids show a considerable number of small pointed teeth in both the anterior and middle parts.

The skull will be seen to be fairly closely allied to the primitive theromorphs *Glaucosaurus* and *Mycterosaurus.* It differs from *Glaucosaurus* in having a long slender snout, and from *Mycterosaurus* in being much more slenderly built and in having a skull very much flatter, and also in having a very large pineal foramen instead of a small one as in *Mycterosaurus.* It manifestly, however, is a near ally of *Mycterosaurus* and *Glaucosaurus.*

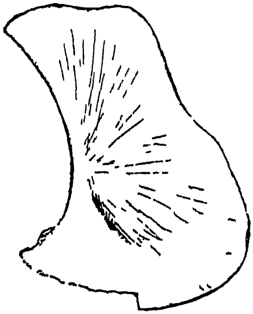

Fig. 4. *Eumatthevia bolli,* n. sp. Type. Left scapula. Amer. Mus. Cope Coll. 7002. Natural size. Internal view.

The following are some of the principal measurements of the skull:

Greatest length	88 mm.
Anteroposterior length of orbit	22 mm.
Anteroposterior length of temporal fossa	11 mm.
Length of the dental series	58 mm.
Length of lower jaw	80 mm.

The vertebræ are for the most part elongated, but considerable further preparation will be required before the detailed structure can be clearly made out.

The left scapula is well preserved and there is also much of the right. The left has its inner aspect displayed. It is short and broad, and the outline can be almost completely restored from the two bones. I find no trace of an ossified coracoid or precoracoid, and I am inclined to think that they have remained cartilaginous and that only the scapula has been ossified.

The humerus is moderately long and slender but not well preserved. It probably measured 47 mm. in length.

The femur probably measured 55 mm. in length and is rather a stronger bone than the humerus.

The tibia measures 47 mm. in length and the fibula 48 mm. The lower end of the fibula is much flattened.

Of the tarsal elements the astragalus and calcaneum are well preserved with the large 4th distal tarsal and much of the 5th distal tarsal and a portion of the 3d.

This primitive theromorph is of very great importance as being not only one of the most primitive known of the American Permian but also as being a connecting link with the primitive therapsids of South Africa through the South African genus *Anningia.* I have therefore much pleasure in naming it after the distinguished American palæontologist Professor W. D. Matthew, who has taken a great interest not only in the Tertiary mammals but also in the Permian fossils, and I have associated the name of Cope's collector Boll with this remarkable find.

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56 81, 4 (1181 78.9)

A NEW SPECIES OF CROCODILIAN FROM THE TORREJON BEDS.[1]

BY CHARLES C. MOOK

INTRODUCTION

In the American Museum collections of fossil reptiles are the remains of a crocodilian from the Torrejon Beds at Torrejon Arroyo, New Mexico. This material was collected by Mr. Walter Granger in 1912. It consists of a nearly perfectly preserved lower jaw, teeth and skull fragments, vertebræ, and limb and girdle bones. No crocodilian remains have hitherto been reported from the Torrejon beds, and the remains under consideration differ considerably from all other crocodilia material available for comparison or described in the literature. The remains are therefore assigned to a new species. Further study may necessitate their reference to a new genus. From the comparisons that have been made, these remains show a greater similarity to *Leidyosuchus* Lambe than to any other known crocodilian genus. The remains are therefore referred to a species of *Leidyosuchus,* though remains of this genus have not hitherto been found above the Cretaceous.

Leidyosuchus multidentatus, new species

TYPE.—Amer. Mus. No. 5179. Complete lower jaws, 12 vertebræ, left ilium, left tibia, several isolated teeth.

TYPE LOCALITY AND LEVEL.—Torrejon Arroyo, New Mexico; Torrejon Beds, Paleocene. Collected by Mr. Walter Granger in 1912.

SUMMARY OF SPECIFIC CHARACTERS.—Mandible very long in proportion to its breadth, the breadth constituting only 29 per cent. of the length, compared with 54 per cent. in *L. sternbergii.* Undulation of alveolar border slight. Number of teeth greater than in other species, being 28 in each ramus. Splenials just reach symphysis, which extends back to the level of the fifth teeth.

DESCRIPTION OF TYPE IN DETAIL.—This species is characterized by a very long slender mandible with a short symphysis, and with a large number of teeth. This combination of characters is rare, or

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[1] Contribution to the Osteology, Affinities, and Distribution of the Crocodilia, No. 19.

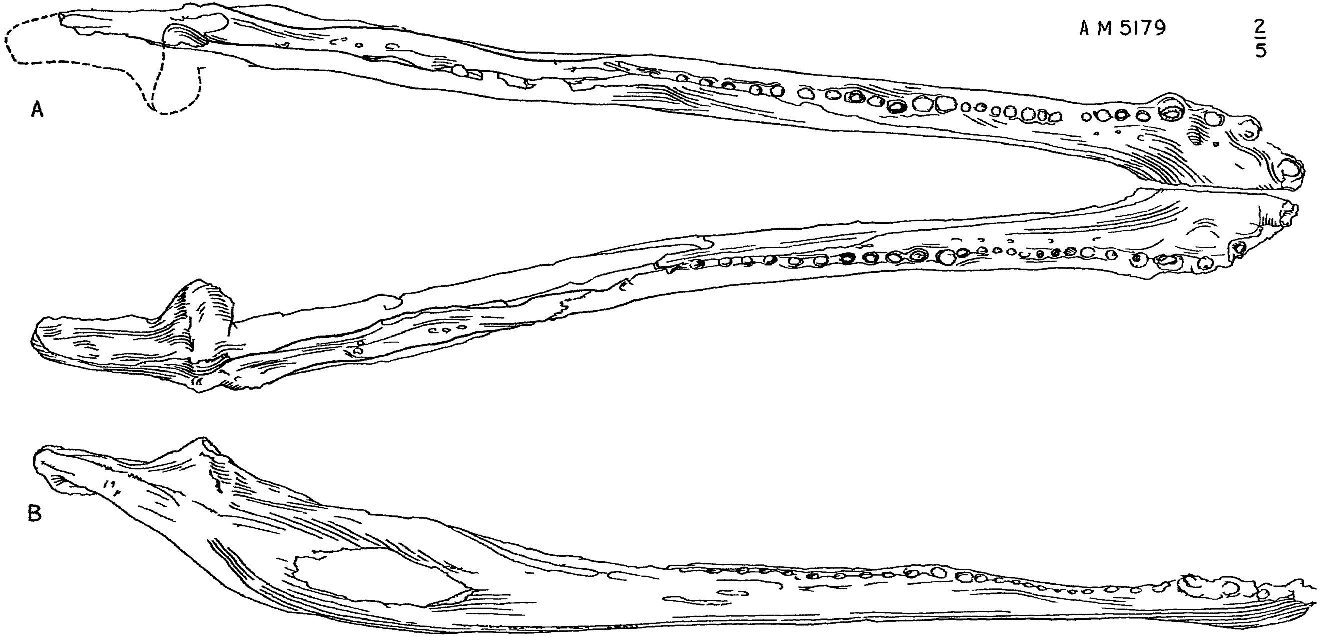

Fig 1 *Leidyosuchus multidentatus*, new species Type, jaws, Amer Mus No 5179 Two-fifths natural size A, superior view, B, lateral view, right side

previously unknown, among the Crocodilia. Invariably, long slender jaws with many teeth possess a long symphysis, with splenial forming a considerable portion of it. This is true irrespective of the systematic position of the example. In the form under discussion the number of teeth and the slender proportions suggest some of the typical long-snouted crocodilians such as the gavials or tomistomas. The symphysis, however, is as short as in the extremely short-snouted crocodilians. The nearest approach to this condition is among some of the relatively short-snouted alligators and caimanoid forms, and the Cretaceous species *Leidyosuchus sternbergii* Gilmore. The alligatoroid forms differ materially from the present species in many characters, but *L. sternbergii* differs chiefly in possessing shorter and broader jaws and less numerous teeth. In many of the details of the jaw structure, the resemblance is striking.

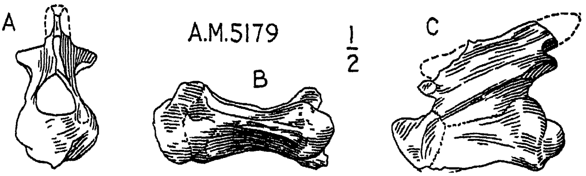

Fig. 2. *Leidyosuchus multidentatus*, new species. Type, axis vertebra (Cervical 2), Amer. Mus. No. 5179. One-half natural size. A, anterior view; B, inferior view; C, lateral view, left side.

The amount of festooning of the alveolar border is very slight. In a jaw the size of the one under discussion this cannot be ascribed to immaturity of the specimen, but must be considered a specific character. The edges of the alveoli of the first four mandibular teeth are elevated somewhat above the alveolar border, and are separated from each other by short diastemata. The first pair of alveoli is near, but not at, the median line. The first alveoli are 9 mm. apart from each other. Alveoli 1 are 10 mm. from alveoli 2. In order of their anteroposterior diameters the alveoli are: Nos. 4, 1, 2, 16, 3, 17. Alveoli 4, 1, 2 are much larger than 16 and 17. The rest of the alveoli are small. Each alveolus is complete in itself, no two alveoli being confluent.

The symphysis extends backward to the level of the fifth mandibular alveoli. The splenials enter the symphysis, but comprise no essential part of it. On either side of the median line, anterior to the level of the fourth mandibular teeth, the superior surface of the dentary is somewhat depressed. In the depression are several pits, somewhat nearer to the alveolar line than to the median line. The shaft of each ramus is very slender, and is broad in proportion to its height. It is subtriangular in cross-section. The external mandibular foramen is small. The region of the internal mandibular foramen is not well enough preserved to permit adequate description.

MEASUREMENTS

Right ramus of jaw	
Length	415.5 mm.
Length of dental row	232 est.
Length of external foramen	52.
Number of alveoli	28
Height, minimum	10
Left ramus of jaw	
Length	409.5 mm.
Length of dental row	232
Length of external foramen	55
Height, minimum	9.5
Number of alveoli	28
Symphysis	
Length	52
Number of alveoli on each side	5
Both rami	
Length along median line	411
Breadth across articular condyles	125
Breadth across symphysis	60

The vertebræ and limb and girdle bones appear somewhat small in comparison with the size of the jaws. This is true, also, however, of the type material of *Leidyosuchus canadense* Lambe.

The vertebræ consist of Cervicals 2, 4, 6, 7, Dorsals 2 and 13, Lumbar 1, Sacral 1 and Caudals 2, 5, and 7. These determinations are provisional, as the number of vertebræ in the crocodilian column is variable, and the specimens themselves are far from complete. The determinations do indicate approximately, however, the positions of the vertebræ preserved. As compared with the axis of an adult *Crocodilus americanus*,[1] the axis of the present specimen is longer in proportion to its breadth. The spine is well preserved except at its distal extremity, and is characterized by a somewhat prominent prespinal lamina. The zygapophyses are well preserved, and have suffered but little crushing. The prezygapophyses are small, but are distinctly discernible. The distance across the prezygapophyses is 60 per cent. of the distance across the postzygapophyses, in comparison with 85 per cent. for the same proportion in *Crocodilus americanus;* it is not likely that this difference is due to crushing of the fossil specimen. In a young specimen of *Alligator mississippiensis,* the prezygapophyses of the axis are broader than the postzygapophyses. A very prominent ridge, or lamina, extends, on each side, upward and backward from the prominent process that supported the axial rib, to the postzygapophysis of the corresponding side. I have not observed a similar lamina in any other crocodilian vertebra. The odontoid region is well developed, but is somewhat indistinguishable from adhering matrix. The body of the centrum is very slender, and terminates inferiorly in a thin, sharp edge; this character may have been accentuated somewhat by crushing. The posterior ball is very prominent. Cervical 4 is less well preserved. The spine, zygapophyses, and most of the lower neural arch region are missing. The diapophysial

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[1] Mook, C. C. 1921. Notes on the Postcranial Skeleton in the Crocodilia. Bull. Amer. Mus. Nat. Hist., XLIV, Art. 8, pp. 67-100, especially 71 and 72. April 12.

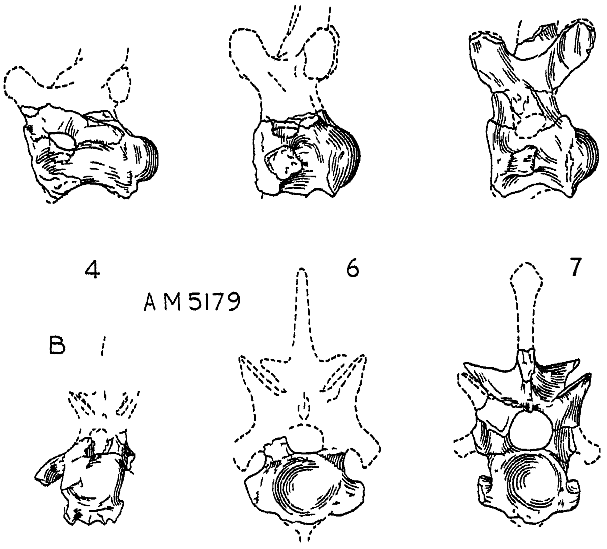

Fig. 3. *Leidyosuchus multidentatus,* new species. Type, cervical vertebræ, Amer. Mus. No. 5179. One-half natural size. A, lateral views, left side; B, anterior views. 4, 6, 7, fourth, sixth, and seventh cervical vertebræ, respectively.

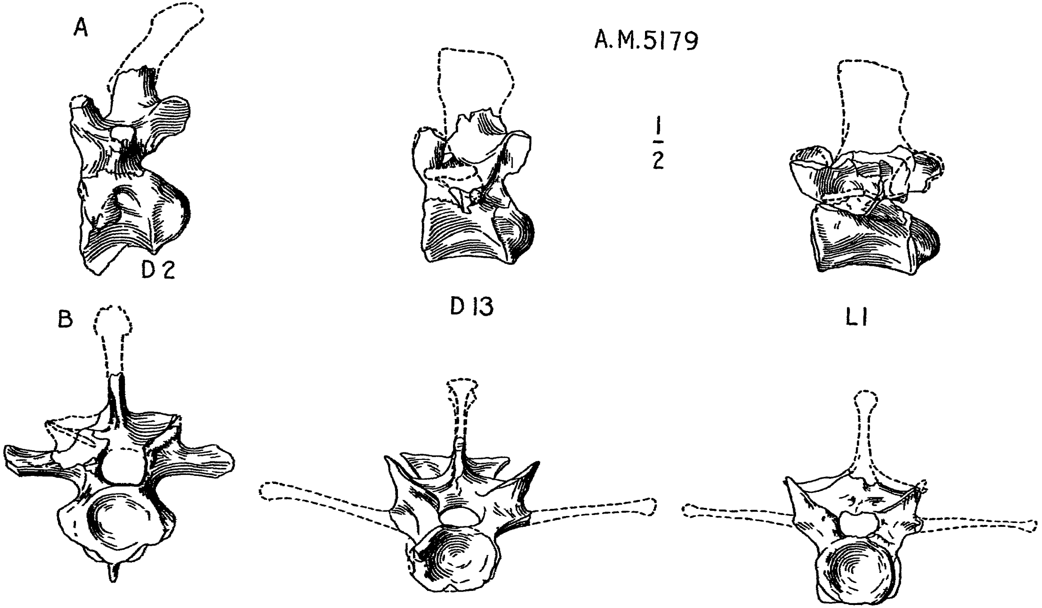

Fig. 4. *Leidyosuchus multidentatus*, new species. Type, dorsal and lumbar vertebræ, Amer. Mus. No. 5179. One-half natural size. A, lateral views, left side; B, anterior views. D2, D13, and L1, second dorsal, thirteenth dorsal, and first lumbar vertebræ, respectively.

process of the right side is well preserved. It is longer and more slender than in *C. americanus.* The parapophyses are prominent. The posterior ball is prominent and occupies a comparatively small portion of the posterior surface of the centrum. The chief distinction between this vertebra and the corresponding vertebra of *C. americanus* appears on the ventral view. In the present specimen the inferior surface of the centrum is decidedly constricted immediately posterior to the parapophyses; in *C. americanus* the centrum maintains a considerable width with only slight constriction. The median keel and hypapophysis show less development in the present specimen than in *C. americanus.* The vertebra provisionally identified as Dorsal 2 is better preserved than Cervical 4. The base of the spine, the postzygapophyses, the prezygapophysis of the right side, the bases of the diapophyses, the parapophyses, and both ends of the centrum, as well as its inferior surface, are present. The prezygapophyses evidently had a greater width than the postzygapophyses. The bases of the diapophyses are located on the sides of the neural arch, slightly above the level of the arch-centrum sutures. The parapophyses are prominent; they occupy considerably less space

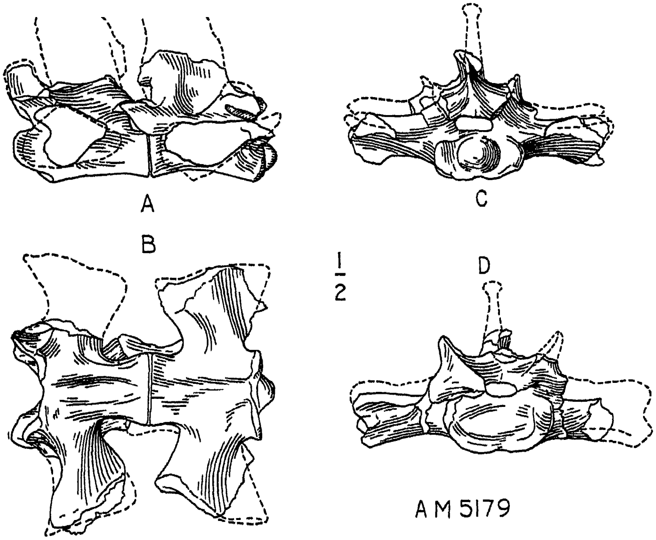

Fig. 5. *Leidyosuchus multidentatus,* new species. Type, sacrum, Amer. Mus. No. 5179. One-half natural size. A, lateral view, left side; B, inferior view; C, posterior view; D, anterior view.

anteroposteriorly than in the corresponding vertebra of *C. americanus.* The flange surrounding the posterior ball of the centrum is prominent. The median keel is prominent; the hypapophysis is not preserved.

The second dorsal vertebra is fairly well preserved. The left pre- and postzygapophyses are preserved. The diapophysial processes arise slightly below the level of the prezygapophysis. These processes are situated far forward on the sides of the centrum; they are characterized by a pair of prominent ridges on their posterior surfaces. The parapophysial processes arise from the anterior portion of the sides of the centrum, slightly above the level of the middle of the centrum; the parapophysial surfaces face obliquely outward and downward. The hypapophysis is prominent. The ball at the posterior end of the centrum is prominent.

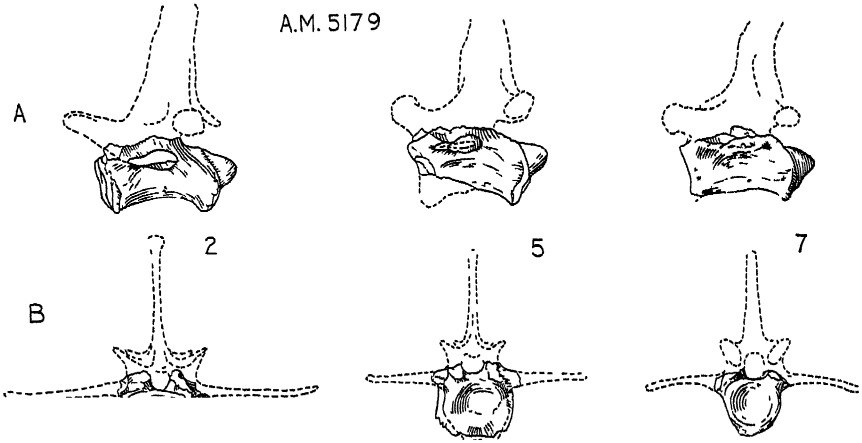

Fig. 6. *Leidyosuchus multidentatus*, new species. Type, caudal vertebræ, Amer. Mus. No. 5179. One-half natural size. A, lateral views, left side; B, anterior views. 2, 5, and 7, second, fifth, and seventh caudal vertebræ, respectively.

The vertebra identified as Dorsal 15 is fairly well preserved. In it the prezygapophyses are larger and much farther apart than the postzygapophyses. The transverse processes which undoubtedly supported both diapophysial and parapophysial articular surfaces, sprung from the sides of the neural arch about midway between the level of the zygapophyses and the superior border of the centrum. The centrum is rather short anteroposteriorly, and is broader than high. The inferior surface of the centrum is broadly rounded.

The first lumbar vertebra articulates fairly accurately with the last dorsal; the prezygapophyses of the former fit rather closely with the postzygapophyses of the latter, and the articulations of the centra agree closely. The broken bases of the transverse processes are not distinctive. The centrum is much longer than that of the last dorsal, and, like that centrum, is wider than high. Its inferior surface is broadly, though irregularly, rounded. The centrum is considerably longer than that of the last dorsal.

The sacrum is incomplete and has been considerably crushed vertically. The two sacrals are united by centra and by the right zygapophyses (the left not being preserved), but whether this union represents a true ankylosis is doubtful. The anterior articular surface of the first sacral is very large. The inferior surface of this vertebra is characterized by two parallel ridges. The inferior surface of the second sacral is broad and flat. The posterior surface of the centrum of Sacral 2 consists of a small posterior ball superposed on a concave surface; this condition is in decided contrast with the centrum of Sacral 2 in modern crocodiles, which is definitely concave. The transverse processes of both sacrals are stout.

The second caudal is incompletely preserved. The anterior cup is broader in proportion to its height than in the first lumbar. The posterior ball is small; it occupies only about half the breadth of the posterior surface of the centrum, and scarcely half of its height. Below the posterior ball the posterior surface of the centrum bends abruptly, facing both downward and backward. The inferior surface of the centrum is not rounded, but is broad and somewhat flat. It makes sharp angles with the sides of the centrum, and is ridged longitudinally with a faint keel. The posterior portion of the inferior surface bends sharply downward. The length of the centrum is the same as in the first lumbar.

The vertebra represented as Caudal 5 resembles that identified as Caudal 2 in many respects. The neural arch and spine are not preserved. The anterior surface of the centrum, as viewed from the side, is oblique in position, facing downward as well as forward. The cup is moderately deep. The posterior ball is small, occupying part of the upper half of the anterior surface of the centrum only; it is somewhat sharp in form. The lower portion of the posterior surface faces obliquely backward and downward. This oblique posterior surface evidently served for articulation with a chevron. The bases of the transverse processes spring from the upper borders of the sides of the centrum; the processes were evidently small. The inferior surface of the centrum is characterized by two

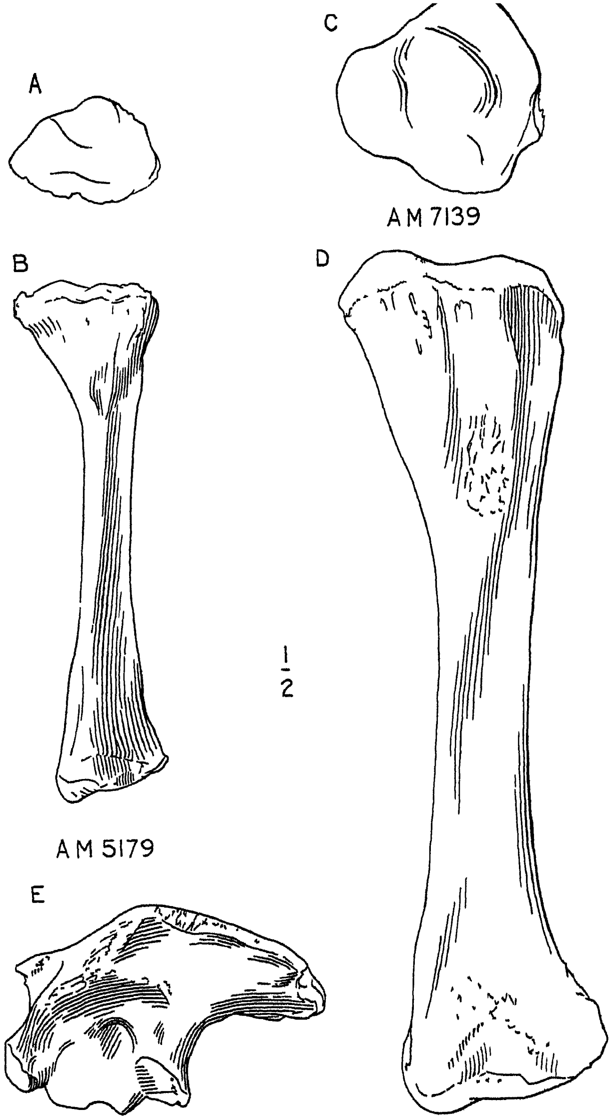

Fig. 7. *Leidyosuchus multidentatus*, new species. Type, left tibia and left ilium, Amer. Mus. No. 5179, and *Crocodilus americanus*, left tibia, Amer. Mus. No. 7139. One-half natural size. A, left tibia of *L. multidentatus*, superior view; B, the same, anterior view; C, left tibia of *Crocodilus americanus*, superior view; D, the same, anterior view; E, left ilium of *L. multidentatus*, external view.

longitudinal ridges that arch toward each other at the center of the midline. The centrum is slightly longer than that of Caudal 2, and slightly narrower.

The seventh caudal resembles the fifth in practically every respect except that it is slightly smaller. The anterior surface is not quite so oblique in position as in the fifth caudal. The posterior surface resembles that of Caudal 5. The inferior surface of the centrum is considerably narrower than that of Caudal 5.

The ilium of the left side is preserved. It is relatively small, and is relatively long in proportion to its height, as compared with an ilium of *Crocodilus americanus*. The posterior process is more slender, and is projected more directly backward than in the American crocodile. The pubic peduncle is relatively weaker than in the recent form, but the ischiadic peduncle is in a similar stage of development. A supraacetabular process, or thickening, is strongly developed in this specimen; it is very inconspicuous in *C. americanus*. The facets for articulation with sacral ribs, on the internal surface of the bone, do not occupy quite so much of the total area of this surface as in the recent form compared; they are not so closely in contact with each other, and apparently were not separated by a vertical flange of bone.

The left tibia only is preserved. It exhibits the normal characters of crocodilian tibiæ, except that the shaft is considerably more constricted than usual, and the proximal end is somewhat more expanded.

Length	137.5 mm.
Breadth, proximal end	39.
Breadth, distal end	30.
Breadth, at narrowest part of shaft	13.5

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56.81, 7A (115:68)

ON A NEW SPECIES OF *ANTHODON* (*A. GREGORYI*)

BY R. BROOM, F.R.S.

The type species of *Anthodon* (*A. serrarius*) was described by Owen in 1876 from a very imperfect skull which is in the collection of the British Museum. The specimen consists of the greater part of the anterior two-thirds of the left side of the skull badly weathered. A number of upper molars are shown but none perfectly preserved. There are probably 11 teeth in the series and those preserved may have had as many as ten cusps, and unlike the teeth in the pareiasaurs of the lower Karroo beds, the crown has the cusps arranged in a very obtuse curve.

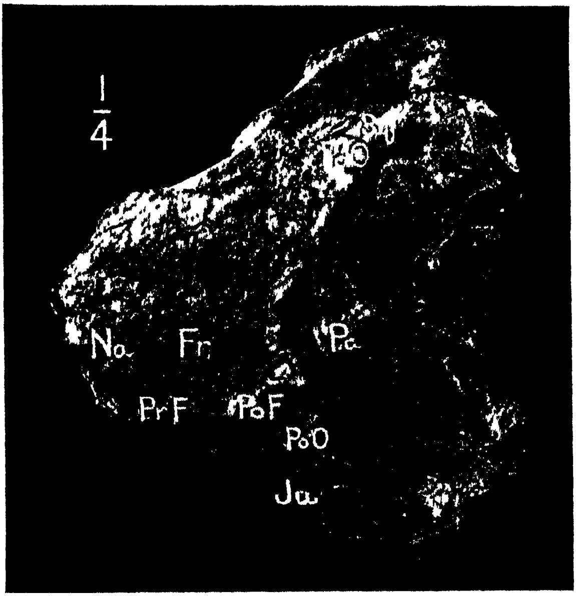

Fig. 1. *Anthodon gregoryi*, n. sp. Type. Skull. Amer. Mus. 7001. One-fourth natural size. Superior view.

Over ten years ago W. C. Kitching discovered near Bethesda Road Station a good skull and much of the skeleton of an *Anthodon*, or allied form [Amer. Mus. 7001]. The skull is typically pareiasaurian but with unusually large deep "cheeks." The back apparently has been completely covered by a bony carapace formed by large articulating bony scutes. The limbs so far as they have been displayed are relatively much shorter than in the typical pareiasaurs.

The skull is nearly perfect, but has lost the front of the snout, and the bones of the parietal and post-parietal region have been weathered off. In practically all the rest of the skull the sutures can be clearly made out.

Fig. 2. *Anthodon gregoryi*, n. sp. Type. Skull. Amer. Mus. 7001. One-fourth natural size. Lateral view, left side.

The frontals are relatively small and removed from the orbital margins by the meeting of the prefrontals and postfrontals. The nasals are wide but short. The lachrymals reach from the orbits to the nostrils. The premaxilla is small and carries 3 incisors. The maxilla is relatively shorter than in typical pareiasaurs, and has apparently 8 molars.

The jugal is largely developed behind the orbit and forms a considerable part of the "cheek."

The prefrontal, the postfrontal, and the postorbital are arranged round the upper side of the orbit and are subequal in size. The parietals are much larger than the frontals, and the pineal foramen is very much larger than in typical pareiasaurs.

The exact limits of the interparietal and the tabulars cannot with certainty be made out. But apparently there is only a simple interparietal and the tabulars are relatively small.

The squamosals are large and the quadratojugals very large.

The mandible differs from that of the typical pareiasaurs in having no horn-like development on the angular.

The following are the chief cranial measurements:

Greatest width of skull	295 mm.
Occiput to snout (about)	240 mm.
Interorbital measurement	123 mm.
Anteroposterior diameter of orbit	48 mm.
Occiput to back of pineal foramen	84 mm.
Pineal foramen	20 mm. × 20 mm.
Greatest length of mandible (about)	165 mm.
Eleven upper molars	116 mm.

The teeth apparently have 8 cusps.

Possibly when *Anthodon serrarius* is better known it may be necessary to place the present specimen as a distinct genus. Certainly it is a distinct species, and I have much pleasure in naming it after Dr. W. K. Gregory, of the American Museum, who by his great work on *Moschops* has placed South African palæontology deeply in his debt.

AMERICAN MUSEUM NOVITATES

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59.7 (51)

SOME CHINESE FRESH-WATER FISHES[1]

By J. T. Nichols

XXVIII.—A COLLECTION FROM CHUNGAN HSIEN, NORTHWESTERN FUKIEN

Realizing that numerous vertebrate species had first come to light from this somewhat remote locality, Mr. Clifford H. Pope took pains to obtain a complete collection of fresh-water fishes here. In the 34 species which comprise it there are only three which are, so far as known, locally endemic, two of these described as new in this paper. However, what might be called the interesting Fukien fish fauna is largely dominant, and, but for recent work in localities faunally allied, there would have been more new forms.

Leiocassis tenuifurcatus, new species

Description of Type.—No. 9681, American Museum of Natural History, from Chungan Hsien, northwestern Fukien, collected April to September, 1926, by Clifford H. Pope.

Length to base of caudal, 155 mm. Depth in this length, 7.7; head, 5. Eye in head, 5; snout, 3; interorbital, 3.7; maxillary, 3; width of mouth, 2.7; maxillary barbel, 3; width of head, 1.4; depth of peduncle, 3.5; its length (from anal axil), 1; dorsal spine, 1.7; pectoral spine, 1.7; longest dorsal ray, 1.3; pectoral, 1.4; ventral 1.6; longest anal ray, 1.7; caudal lobe, 1.1; length of adipose, 1; its height, 5.5; dorsal interspace, 0.7.

Dorsal, I, 7; anal, 18.

Body not compressed in front, compressed behind; eye somewhat superolateral; interorbital slightly convex; snout, rather soft and shapeless, extending distinctly beyond the transverse mouth; lips thick, slightly striate; orbital rim with a slight fold; top of head covered by thick skin, the backward bony process from the skull not quite meeting the forwardly directed one from dorsal plate; gill-membranes narrowly joined at base, free from isthmus; scapular process exposed, pointed, striate. Dorsal spine with slight serrations behind; pectoral spine smooth in front, barbed behind; pectoral reaching two-thirds the distance to ventral, ventral five-sevenths to anal; adipose low in front, moderate and free behind; caudal deeply forked, with broad lobes, the upper and lower groups of rays connected by membrane in the notch; moderate keels on the peduncle above and below; dorsal origin slightly nearer end of snout than to anal origin, its distance from snout 2.5 in that from base of caudal.

Color in alcohol: body and fins dark purplish gray, paler below.

A single cotype has standard length 160 mm.; depth, 6.5; head, 5; eye, 5; anal rays, 19.

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History, Contribution No. 105.

Botia compressicauda, new species

Description of Type.—No. 9682, American Museum of Natural History, from Chungan Hsien, northwestern Fukien, collected April to September, 1926, by Clifford H. Pope.

Length to base of caudal, 91 mm. Depth in this length, 5.9; head, 4.7. Eye in head, 10; snout, 3.1; interorbital, 8; maxillary, 3.8; maxillary barbel, 6; width of body, 2.2; depth of peduncle (forward of keels), 1.7; its length, 1.3; pectoral, 2; ventral, 2.2; longest dorsal ray, 2; longest anal ray, 2; caudal lobe, 1.2.

Dorsal, 9; anal, 7. Scales about 165.

Body strongly compressed, particularly the peduncle; mouth inferior, strongly curved; two barbels on snout and one on maxillary (on each side); small eye with a free rim; a small erectile backwardly-directed spine below eye; gill-membranes broadly joined to breast below origin of pectoral. Dorsal origin midway between base of caudal and middle of opercle, over ventral base; pectoral reaching one-fourth the distance to ventral, ventral one-half to anal; caudal moderately forked; the peduncle expanded in regularly scaled keels above and below.

Color in alcohol purplish gray, rather uniform; fins grayish; caudal paler, delimited by a narrow dusky streak across its base.

Eight cotypes, measure 63 to 93 mm. in standard length, have the dorsal origin midway between base of caudal and the hind third of preopercle to margin of opercle, and the largest have vague dark marks on the caudal.

The 34 species in the Chungan Hsien collections may be analyzed as follows.

Known only from Chungan Hsien

1.	*Liobagrus anguillicauda* Nichols.	Many
2.	*Leiocassis tenuifurcatus*, new.	2
3.	*Botia compressicauda*, new.	9

Known from Fukien

4.	*Leiocassis crassilabris macrops* Nichols.[1]	Few
5.	*Glyptosternon fokiensis* Rendahl (not typical).[1]	Few
6.	*Barbus caldwelli* Nichols.	Few
7.	*Barbus hemispinus* Nichols.	Few
8.	*Homaloptera caldwelli* Nichols.	Many
9.	*Crossostoma davidi*, Sauvage.	Many
10.	*Crossostoma fascicauda* Nichols (not typical).[2]	Many
11.	*Hemimyzon zebroidus* Nichols.	Many
12.	*Siniperca elongata* Nichols.	3

Known from Formosa and Fukien

13.	*Barbus matsudai* (Oshima)	Few
14.	*Varicorhinus tamusuiensis* (Oshima)	Many
15.	*Megalobrama macrops* (Günther)	Few

---

[1] Also from Hokou, northeastern Kiangsi.

[2] A majority of specimens much like *fascicauda* and quite unlike *davidi*, but a small minority are intermediate between these two forms.

Described from Chekiang

16.	*Opsariichthys chekianensis* Shaw (Chekiang).	1
17.	*Gobius davidi* Sauvage and Dabry de Thiersant (western Chekiang).	Many

Known from the Yangtze Valley and Fukien

18.	*Leiocassis tenuis* (Günther).	Many
19.	*Acheilognathus barbatus* Nichols (not typical).	1
20.	*Pseudogobio sinensis* (Kner).	1
21.	*Siniperca scherzeri* Steindachner.	2

Of General Southerly Distribution

22.	*Fluta alba xanthognatha* (Richardson).	Many
23.	*Clarias fuscus* (Lacépède).	Many
24.	*Hemiculter dispar* Peters.	Few
25.	*Cobitis taenia dolicorhynchus* Nichols.	Few

Of General Northerly Distribution

26.	*Parasilurus asotus* (Linnæus).	Few
27.	*Opsariichthys bidens* Günther.	Few

Of General Distribution

28.	*Anguilla japonica* Temminck and Schlegel.	Few
29.	*Pseudobagrus fulvidraco* (Richardson).	Few
30.	*Cyprinus carpio* Linnæus	1
31.	*Carassius auratus* (Linnæus)	2
32.	*Zacco platypus* (Temminck and Schlegel).	Few
33.	*Hemibarbus labeo* (Pallas).	2
34.	*Misgurnus anguillicaudatus* (Cantor).	Few

One half the forms (first four groups) have a more local distribution, as compared with the other half with a general distribution.

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59 87, 2 B (81)

A NEW RACE OF *BRACHYGALBA LUGUBRIS* FROM NORTHEASTERN BRAZIL

BY FRANK M. CHAPMAN

While preparing a report on our collections of birds from the Mt. Roraima area, it was discovered that the form of *Brachygalba lugubris* from northeastern Brazil differed markedly from the other races of this species. It appears to lack a name and to avoid describing it in a paper relating to a wholly different area I present its characters herewith.

It gives me a very real pleasure to name this interesting bird in honor of Mrs. Elsie M. B. Naumburg in recognition of her valuable and long-continued studies of Brazilian birds.

Brachygalba lugubris naumburgi, new subspecies

SUBSPECIFIC CHARACTERS.—Resembling *Brachygalba lugubris lugubris* (Swainson) but back greenish black (instead of snuff-brown) with a brownish wash anteriorly; breast and sides greenish black (instead of snuff-brown washed with rusty); the lower tail-coverts and tibiæ blacker; the chin averaging whiter, the throat more rufescent.

Resembling *Brachygalba lugubris melanosterna* Sclater, but bill shorter and heavier, entirely black (instead of maxilla brown, mandible wholly or largely flesh-color), the throat averaging more, the crown less rufescent.

TYPE.—No. 242,506, Amer. Mus. Nat. Hist.; ♂ Therezina, Piauhy, Brazil; May 1, 1926; E. Kaempfer.

RANGE.—Northeastern Brazil in the states of Para, Maranhão and Piauhy, and Goyaz.[1], [2]

SPECIMENS EXAMINED

Brachygalba lugubris naumburgi.—Brazil: Therezina, Piauhy, 2; Parnahyba, Piauhy, 1; Rosario, Maranhão, 6.

Brachygalba lugubris melanosterna.—Brazil: Chapada, Matto Grosso, 17; Utiarity, 2.

Brachygalba lugubris lugubris.—Roraima, 12 (essentially topotypical). Venezuela: mouth of Rio Ocama (Orinoco, above Esmeraldas), 4.

Brachygalba lugubris fulviventris.—Colombia: Villavicencio (E. Bogotá region), 3; Buena Vista, above Villavicencio, 2.

---

[1] An immature male recorded from Certeza by Hellmayr who, for lack of material for comparison refers it and five specimens from Maranhão to *B lugubris lugubris*.

[2] A specimen recorded by Snethlage from Barão on the east bank of the Tocantins should probably be referred to this race and constitutes the most western record; but a specimen recorded by the same author from Montealegre on the north bank of the Amazon may be referable to true *lugubris*.

Brachygalba lugubris caquetæ.—Colombia: La Morelia, Rio Bodaquera, 5 (inc. type); Florencia, 1. Ecuador: Napo, 2 (trade skins).[1]

The form here described has the general coloration of *Brachygalba lugubris melanosterna* of southern central Brazil, from western Minas Geraes to Bolivia, combined with the jet-black bill of *Brachygalba lugubris lugubris* from British Guiana to the Duida region and is thus intermediate between the two.

With *melanosterna* there is no reason to doubt its actual intergradation through contact. With true *lugubris* such contact is prevented by the Amazon. Nevertheless, the two forms, in spite of the well-marked differences separating them, are so closely related that their intergradation would doubtless occur should their ranges adjoin.

Four specimens from the upper Orinoco have the brown areas materially darker than in those from Roraima. This difference seems in part due to season (they were taken in March and are in fresher plumage than the October–December series from Roraima); but whether or not it is also in part racial, it helps to bridge the differences between *lugubris* and *naumburgi*.

Farther west, *fulviventris* of northern Colombia, east of the Andes, differs from *lugubris* only in its somewhat richer brown areas and fulvous-washed abdomen; while in *caquetæ*, of southeastern Colombia and eastern Ecuador, this type of variation is still further developed.

Brachygalba goeringi of northern Venezuela and *Brachygalba salmoni* of the Antioquia region of Colombia and eastern Panama are apparently representatives of this group, and the systematist, who without regard to degree of differentiation, intergradation, or non-intergradation ranks all representative forms as subspecies, would doubtless so regard them. But in the belief that a more discriminating use of nomenclature will better express existing relationships, I should give them both full specific rank.

Brachygalba inornata (Sclater), said to be from "Brazil,"[2] but entered in the 'Catalogue of the British Museum' as from "Amazonas (?)," is described as "nearly uniform brown, lightest on the top of the head and breast. . . . " It is therefore apparently correctly placed (*loc. cit.*) under *Brachygalba lugubris*.

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[1] A specimen recorded under "*Brachygalba lugubris*" from Pebas, Peru, in the 'Catalogue of the British Museum' (XIX, p 172), should presumably be referred to *caquetæ*

[2] Jardine's 'Cont. Orn ,' 1852, p 32

MEASUREMENTS

	Sex	Wing	Tail	Culmen
B. l. naumburgi, Parnahyba, Piauhy	♂	71	50	45
“ “ “ Therezina, “	♂	73	50	46
“ “ “ Rosario, Maranhão	♂	73	51	49
“ “ “ “ “	♂	72	51	50
“ “ “ “ “	♀	71	51	50
“ “ “ Therezina, “	♀	73	50	48
B. l. melanosterna, Chapada, Matto Grosso	♂	71	51	45
B. l. melanosterna, Chapada, Matto Grosso	♂	70	50	43
B. l. melanosterna, Chapada, Matto Grosso	♂	71	50	45
B. l. melanosterna, Chapada, Matto Grosso	♀	71	51	43
B. l. melanosterna, Chapada, Matto Grosso	♀	70	48	45
B. l. lugubris, Phillip Camp, Roraima	♂	73	52	48
“ “ “ Paulo, “	♂	72	52	47
“ “ “ “ “	♀	71	55	48
“ “ “ Orinoco and Ocama, Ven.	♂	71	52	46
“ “ “ “ “ “	♀	72	49	43
B. l. fulviventris, Buena Vista, Col.	♂	70	49	46
“ “ “ Villavicencio, Col.	♀	72	50	48
“ “ “ “ “	♂	69	47	46
B. l. caquetæ, La Morelia, Col.	♂	72	51	44
“ “ “ “ “	♂	69	47	45
“ “ “ “ “	♀	70	51	45
B. goeringi, El Cuji, Lara, Ven.	♀	68	55	48
B. salmoni, Tapaliza, E. Pan.	♀	72	54	49
“ “ “ “	♂	72	52	48

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NEW CICHLID FISHES FROM LAKE NYASSA

BY J. T. NICHOLS AND F. R. LAMONTE[1]

The Museum has recently received a collection of fishes obtained in the summer of 1929 by R. and L. Boulton of the Straus African Expedition, from Karonga and Deep Bay, two points on the western shore near the northern end of Lake Nyassa. The great majority of these are cichlids

The cichlids of the lake have been reviewed by Regan,[2] and several new species since described by Ahl,[3] but two of our twenty-six species appear to be new. A table, following Regan's classification, will give an idea of the abundance of these fishes in Lake Nyassa and the extent of the present collection.

GENUS	NUMBER OF SPECIES			
	In Regan, 1921	Added by Ahl, 1927	To Hand	New
Tilapia	4		2	
Corematodus	1			
Hemitilapia	1			
Otopharynx	2		2	
Chilotilapia	1			
Astatotilapia	1			
Pseudotropheus	5	1	3	
Labeotropheus		2	1	
Cynotilapia	1		1	
Serranochromis	1		1	
Haplochromis	52	7	16	2
Lethrinops	4	3		
Docimodus	1			
Cyrtocara	3			
Rhamphochromis	6	2		
Aulonocara	1			

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[1] Drawings of the type specimens by Mrs Helen Ziska

[2] Regan, 1921, Proc. Zool Soc London, II, pp 675–727

[3] Ahl, 1927, Sitz Ges N F Berlin, for 1926, pp 51–62

Statistically, these figures would indicate that habitats in the lake comparable to those from which collections have been made contain some 107 recognizable cichlids, or that about 94 per cent of their cichlid fauna has been described.

We have in the collection, for comparison with the two forms described as new, the following species:

Tilapia melanopleura Duméril; young.	Deep Bay
Tilapia shirana (Boulenger).	Karonga and Deep Bay
Otopharynx auromarginatus (Boulenger).	Deep Bay
Otopharynx selenurus Regan; one.	Karonga
Pseudotropheus williamsi (Günther).	Karonga and Deep Bay
Pseudotropheus zebra (Boulenger).	Deep Bay
Pseudotropheus novemfasciatus Regan.	Deep Bay
Labeotropheus fulleborni Ahl.	Deep Bay
Cynotilapia afra (Gunther); one.	Deep Bay
Serranochromis thumbergii (Castelnau); one.	Deep Bay
Haplochromis johnstoni (Gunther); one young.	Deep Bay
Haplochromis kirkii (Gunther).	Karonga
Haplochromis similis Regan; one.	Deep Bay
Haplochromis urotaenia Regan; one.	Karonga
Haplochromis strigatus Regan; one.	Karonga
Haplochromis dimidiatus (Gunther).	Karonga
Haplochromis auritus Regan.	Karonga
Haplochromis tetrastigma (Gunther).	Deep Bay
Haplochromis chrysonotus (Boulenger).	Deep Bay
Haplochromis sphærodon Regan.	Deep Bay
Haplochromis macrophthalmus (Boulenger).	Karonga
Haplochromis leuciscus Regan.	Karonga and Deep Bay
Haplochromis compressiceps (Boulenger).	Karonga and Deep Bay
Haplochromis macrorhynchus Regan; one.	Karonga

Our specimens of *Pseudotropheus williamsi* indicate that it is variable and that *P. zebra* is closely related and can not be separated by the characters used in Regan's synopsis of the species of *Pseudotropheus*. The diagnostic characters of *P. zebra* seem to be an appreciably longer lower jaw and smaller conical teeth on the side of the upper jaw, more or less gibbous nape and concave profile, ventrals with filamentous tips reaching well past front of anal. Our three specimens of *P. zebra*, 78 to 90 mm. standard length, are dusky like most of our *P. williamsi*, some of which, however, are banded.

Haplochromis dimidiatus and *H. macrophthalmus* seemingly become more slender with increase of size. Our specimens of the former, 57–95 mm. standard length, have depth 3.3 to 3.6, versus 4 given by Regan who had larger material. Our three specimens of *H. macrophthalmus* have depth 2.7 (at 66 mm. standard) and 3.3 (79 and 90 mm.).

Haplochromis centropristoides, new species

DESCRIPTION OF TYPE. No. 9683, American Museum of Natural History, from Karonga, Lake Nyassa; June 30, 1929; collected by R. and L. Boulton of the Straus African Expedition.

Length to base of caudal, 88 mm. Depth in this length, 2.8; head, 3. Eye in head, 4; snout, 2.6, equal to postorbital part of head; maxillary, 2.7; interorbital, 4.1; greatest thickness of body (at shoulder), 1.9; depth of peduncle, 2.6; its length, 2.5; longest dorsal spine, 2.4; longest dorsal ray, 1.5; third anal spine, 2.8; longest anal ray, 1.6; pectoral, 1.4 (not reaching to over anal origin); ventral, 1.2 (its filamentous tip passing anal origin); caudal, 1.5.

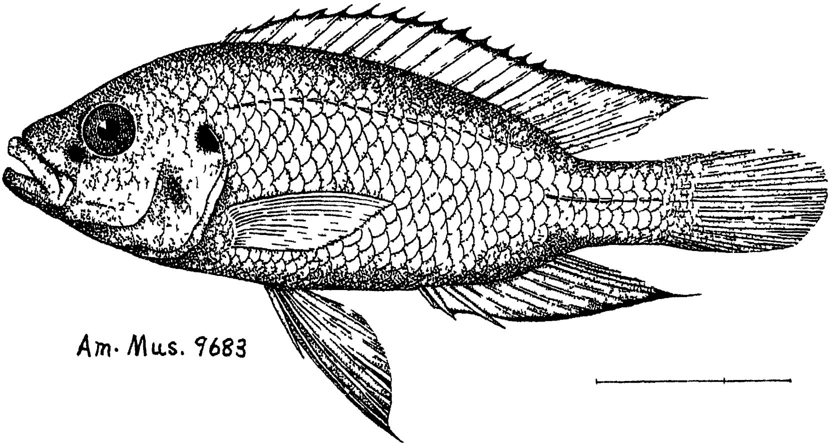

Fig. 1. *Haplochromis centropristoides*, type.

Dorsal, XV, 11; anal III, 9. Scales, 30; lateral lines 20+9; $4\frac{1}{2}$ rows of scales between lateral line and dorsal, 10 between lateral line and ventral; 3 or 4 on the cheek; 16 around peduncle. Teeth in rather broad bands in the jaws; outer row moderately enlarged, bicuspid; 13 gill-rakers on the first arch, 9 on its lower limb.

Profile slightly concave; nape broad and slightly elevated; jaws equal; mouth moderately oblique; maxillary not quite to under front margin of eye. Caudal obliquely truncate, its upper rays somewhat the longer. Scales slightly ctenoid, small and cycloid on the chest, extended forward on the top of the head to a little beyond the center of the eye. Color in spirits, including the fins, rather uniform dusky, the front of the ventral and margins of the vertical fins darkest.

Apparently close to but distinct from *H. fuscus* Regan, 1925, from Lake Edward; with smaller mouth, less elevated nape, more dorsal rays, more pointed fins, etc.

Haplochromis boultoni, new species

Description of Type.—No. 9684, American Museum of Natural History, from Karonga, Lake Nyassa; about July 1, 1929; collected by R. and L. Boulton of the Straus African Expedition.

Length to base of caudal 80 mm. Depth in this length, 4.5; head, 3.1. Eye in head, 4; snout, 2.6 (equal to postorbital part of head); maxillary, 3.1; interorbital, 4.9; thickness of body, 2.9; depth of peduncle, 3.3; its length, 2; longest dorsal spine, 2.9; longest dorsal ray, 2.6; third anal spine, 2.9; longest anal ray, 2.9; pectoral, 1.5; ventral, 1.7; upper caudal lobe (the longer), 1.4.

Dorsal XVIII, 12; anal III, 10. Scales, 38; lateral lines 25+ about 16; 4½ rows between lateral line and dorsal, about 10 between same and ventral; 3 or 4 on the cheek; 18 around peduncle. Teeth all conical, an outer series of somewhat irregular, well-spaced enlarged teeth and two or three inner series; pharyngeal teeth small and pointed; 11 small gill-rakers on the lower limb of the first arch.

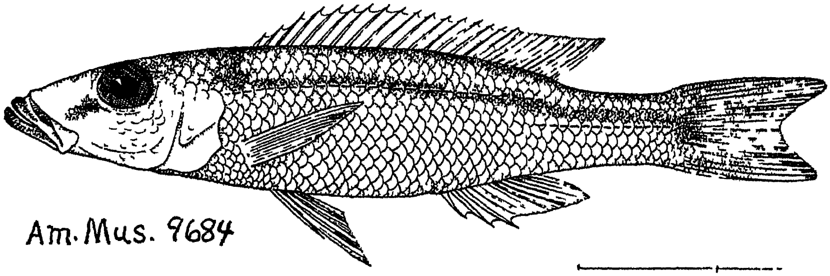

Fig. 2. *Haplochromis boultoni*, type.

Profile low and straight, touching upper rim of eye; back not elevated; lower jaw slightly projecting; mouth oblique; maxillary not nearly to under front margin of eye. Ventrals not quite reaching vent; caudal shallowly forked, the upper lobe the longer. Scales slightly ctenoid, small on chest, forward on top of head to middle of eye or beyond. Color in spirits brownish gray above, silvery white on sides and below, a dark blotch forward and slightly downward from the eye; a dark band, mostly about as wide as a scale, from the shoulder backward and downward to the base of the caudal, ending in a dark spot on the base of the middle caudal rays, and with an obscure arc curving upward and backward at its front end toward the dorsal origin. Fins colorless, except faint markings on the dorsal, and dark shades on the caudal lobes, that on the lower somewhat the more pronounced.

This seems to be closest to Regan's *Haplochromis spilorhynchus*. A larger number of dorsal spines and scales and fewer rows of scales on the cheek substantiate other differences therefrom, which might be due to size.

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SOME BEES COLLECTED BY PROFESSOR JACOT IN CHINA

By T. D. A. Cockerell

The following bees, collected in Tsinan, China, in the spring of 1930, were sent by Professor Arthur Jacot, of the Shantung Christian University. For previous accounts of bees from this locality see Entomologist, September, 1929 and April, 1930.

Chalicodoma desertorum tsinanensis Cockerell

Described from the female. Five males are now sent, taken March 23. They agree with the brief description of male *C. desertorum*, except that the mandibles are entirely dark.

Osmia jacoti Cockerell

This was described from the female. A series of six males, collected at flowers of *Viola*, March 23, consists of three *O. jacoti* and three *O. subtersa* Cockerell. These two species, in the male, vary in size and color (one *C. subtersa* is only 6.5 mm. long) and are in all respects closely allied. In *O. jacoti* the hair of the face is a slightly sordid or brownish white, as against the snow-white of *O. subtersa*. The abdomen of *O. jacoti* is olive-green to almost black, that of *O. subtersa* more or less distinctly steel-blue, sometimes quite bright. The notch in the sixth tergite of *O. jacoti* is deep and semicircular; both species have the seventh ending in two sharp spines. The genitalia distinctly differ, the stipites being thick and obtuse at end in *O. subtersa*, slender and pointed in *O. jacoti*; while the sagittæ in *O. subtersa* are more obtuse at end (see figure).

Anthophora melanognatha Cockerell

Two males and a female, at *Astragalus*, April 2. The males differ from the type in having a small yellow spot on the mandibles. The female has red hair on the hind tibiæ and tarsi. The male face markings are light yellow, not orange as in *A. fulvitarsis* Brullé.

Anthophora patruelis, new species

MALE.—Length, 13-15 mm. (varying with extension of abdomen); anterior wing 10.5 mm.; very robust, black, the body with long and abundant gray (not at all fulvous) hair, the gray effect due to a combination of white and black; face-markings very pale yellow, including the shining clypeus (except lateral lobes, very small mark at each side, and linear lower margin), narrow supraclypeal band, labrum (except lower edge and large lateral tubercles), and remnants of lateral face marks, which are reduced to a short band next to clypeus (appearing to deviate from it at lower end, but this effect due to the fact that the lateral lobes of clypeus are black), and two very minute spots (the upper often absent) on orbital margin; scape broadly light yellow in front; flagellum entirely black; third antennal joint as long as next three together; face with long white hair, but some black at sides; thorax with abundant long white hair, mixed with black on disc; tegulæ black; wings dusky; basal nervure meeting nervulus; legs with long pale fulvous hair; spurs light ferruginous; joints two to four, and base of fifth on middle and hind legs ferruginous, dusky at end; middle basitarsi broadened, the apical half anteriorly with a brush of black hair, and a little on posterior side, while the last joint of these tarsi has a long black fringe on each side; hind basitarsi not toothed; abdomen with long shaggy white hair, forming conspicuous bands on tergites two to four, but there is long black hair before these bands; genitalia very robust, ferruginous, of complicated form, as shown in the figure.

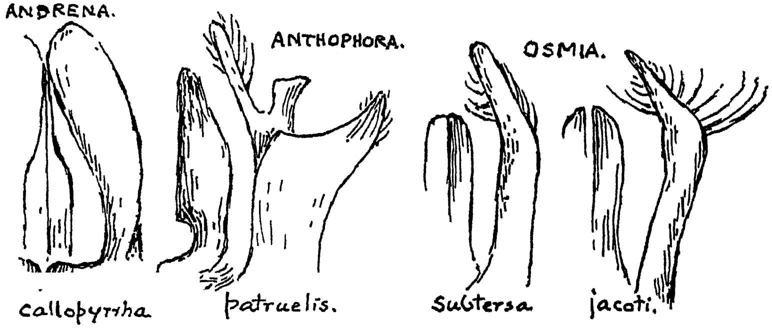

Fig. 1. Male genitalia.

Tsinan, April 3, 1930, six males at *Astragalus*.

Looks like a small *A. melanognatha,* but easily distinguished by the reduced lateral face marks, and from most of the allied species by the entirely black mandibles. The stipites are much longer, narrower and paler than in *A. acervorum lisbonensis* Cockerell, which has very similar pubescence on thorax and abdomen. The genitalia are also quite distinct from those of *A. fulvitarsis* Brullé, which is a related species.

Tetralonia jacoti (Cockerell)

Tetralonia chinensis jacoti Cockerell, 1930, Entomologist, LXIII, p. 84, ♀.
Tetralonia polychroma Cockerell, 1930, Entomologist, LXIII, p. 85, ♂.

These are proved to be one species by a pair taken mating, April 5, by Professor Jacot. Males were also taken March 25, 28, and April 2. The species is certainly distinct from *T. chinensis*. The mating male has the dorsal hair of thorax very pale yellowish, shining white, but most males show the rich fox-red hair.

Andrena callopyrrha Cockerell

Described from the female. The present lot contains thirteen males, taken March 25 and April 3. The male closely resembles the female except in the usual sexual characters. The head and thorax are covered with red hair; face very broad, its tegument entirely black; abdominal bands light fulvous, broadly interrupted on second tergite; tibiæ and tarsi red, the anterior tibiæ variably blackened on outer side; hind femora red, more or less clouded with black. Mandibles slender, ordinary, and cheeks rounded. For genitalia see figure. In Schmiedeknecht's table (Apidæ Europææ) this runs directly to *A. xanthura* Kirby (*wilkella* Kirby), from which it is readily distinguished by the more shining abdomen and the color of the pubescence. The third antennal joint is considerably longer than the fourth, yet not nearly twice as long. Two of these males carry *Stylops*.

Specimens of all these species, including the holotype of the new *Anthophora*, are in The American Museum of Natural History.

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TWO NEW MEALY-BUGS (COCCIDÆ) IN NESTS OF ANTS (*LASIUS*)

BY ELMER D. BUEKER

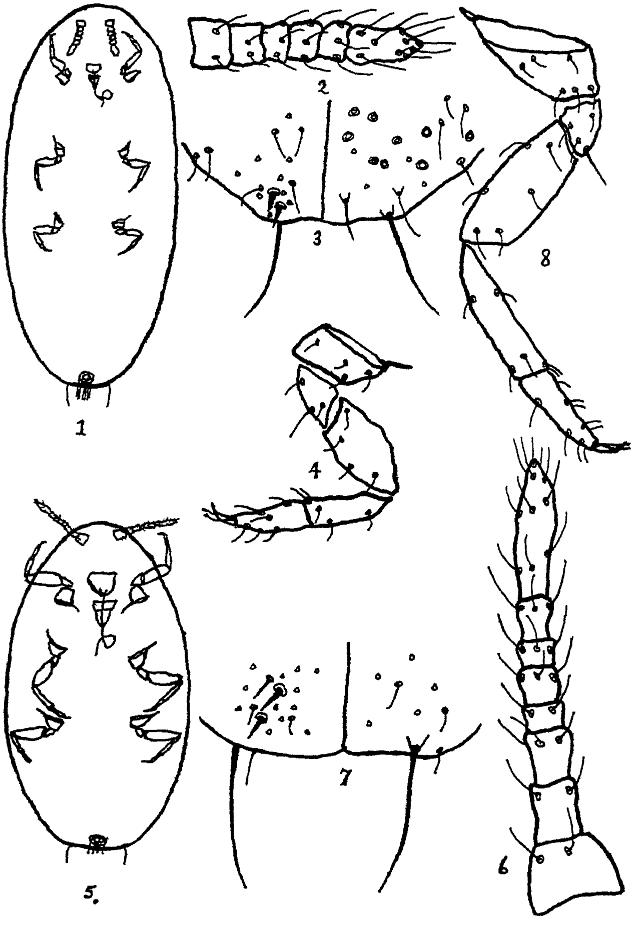
Two species of *Coccidæ*, apparently new to science, were found by the author. Both live in the nests of ants of the genus *Lasius*. The following form was found in Blue Bell Canyon, south of the Chautauqua, Boulder, Colorado, on a slope facing the northwest. The entire slope is covered with a dense growth of brush and grass. Upon turning over a rock, a number of small white globular objects were seen attached to the roots of grass belonging to the genus *Poa*. More rocks were removed and some coccids were found in the nests of *Lasius;* perhaps their association with ants is accidental. In MacGillivray's 'The Coccidæ,' this species goes into the genus *Cryptoripersia*. I can find no description of this form in any of the available literature. All measurements are given in microns, unless otherwise indicated.

Cryptoripersia leucocystis, new species

ADULT FEMALE BEFORE MOUNTING.—Ovate; almost round; length, including waxy covering, 1.7 to 2 mm.; width, with waxy covering, 1 to 1.2 mm.; waxy coat thin, brittle, and pure white; upon removing the covering the female was found to be a light yellow; near posterior end of the animal the waxy covering incloses numerous eggs.

ADULT FEMALE WHEN MOUNTED.—Ovate; length 1.4 mm.; width 1.1 mm. Antennæ six-segmented; lengths of segments examined: (1) 23; (2) 20, (3) 14; (4) 16; (5) 13; (6) 45. Middle leg: coxa 30; trochanter + femur 95, tibia 53; tarsus 48; claw 18 on outer surface; two digitules slightly knobbed at the ends are attached to the base of each claw. Beak: length 70; width 53. Anal lobes well developed; only one pair of cerarii which are located on anal lobes. Each cerarius composed of the following: two short thick conical spines; three to six triangular wax glands; two auxiliary setæ. Twenty to thirty ocular wax glands on the ventral side of each abdominal segment; a few triangular wax glands scattered over the derm dorsally and ventrally. Six anal-ring setæ, each seta about 60 microns in length. One anal-lobe seta on each lobe, 75–80 in length; a few slender setæ covering the entire derm. Anal ring with double pore bands, pores of inner band are slightly smaller than those of the outer band.

South of the Chautauqua, Boulder, Colorado; April 9 and 13, 1930; Coll. E. D. Bueker.



Figs. 1 to 4. *Cryptoripersia leucocystis:* (1) outline of body of adult female, × about 30; (2) antenna, × about 150; (3) left half of figure showing dorsal side of body with anal-lobe cerarius, right half showing ventral aspect, × about 150; (4) middle leg, × about 200.

Figs. 5 to 8. *Trionymus interjecti:* (5) outline of body of adult female, × about 30; (6) antenna, × about 150; (7) left half of figure showing dorsal side with anal-lobe cerarius, right half showing ventral view, × about 150; (8) hind leg, × about 150

The following form was found underneath a rock in a nest of *Lasius interjectus* Mayr. Specimens were feeding on the roots of grass of the genus *Poa*. Immature forms are long and narrow, yellow and quite active. Mature forms are about 1.5 mm. in length and 1 mm. in width, yellow to pale pink.

Trionymus interjecti, new species

ADULT FEMALE.—Ovate; length before mounting 1.5 mm.; width 1 mm.; yellow to pale pink; two caudal waxy tassels. Antennal segments as follows: (1) 40; (2) 35; (3) 30; (4) 20; (5) 24; (6) 20; (7) 30; (8) 76. Middle leg: coxa 50; trochanter+femur 163; tibia 110; tarsus 63; width of femur 43; two digitules attached to the base of each claw, each digitule slightly knobbed at the distal end. Anal lobes fairly well developed; two pairs of cerarii. Anal-lobe cerarius as follows: three conical spines; fourteen to eighteen triangular wax glands; two to three auxiliary setæ. Second cerarius: one conical spine; four to six triangular wax glands. On ventral side of each abdominal segment are forty to sixty large ocular wax glands, fifteen to twenty on lateral margins of thoracic segments and head; entire derm covered with numerous triangular wax glands dorsally and ventrally. Six anal-ring setæ, length of each about 160. Anal ring with outer and inner pore bands.

Antennal lengths of six-segmented forms as follows: (1) 32; (2) 25; (3) 38; (4) 20; (5) 28; (6) 76. Two pairs of cerarii. Anal cerarius as follows: two conical spines; two heavy auxiliary setæ which are conelike in appearance; ten to fourteen triangular wax glands. Second cerarius: one conical spine; three to five triangular wax glands.

South of the Chautaqua, Boulder, Colorado; March 30, 1930; Coll. E. D. Bueker.

On the whole, my species comes close to *Trionymus nanus* Cockerell, but it differs in the following characters:

Anal lobe cerarius with fourteen to twenty triangular wax glands as against eight to twelve in *Trionymus nanus* Cockerell.

About forty to sixty large ocular wax glands on the ventral side of each abdominal segment. (Only twelve to twenty in *T. nanus* Cockerell.)

Antennæ eight-segmented as against seven-segmented in *Trionymus nanus* Cockerell.

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A REVISION OF THE GENUS *APHRISSA*

BY F. MARTIN BROWN

The genus *Aphrissa* Butler, along with *Phœbis* Hübner, is usually found classified as *Callidryas* Boisduval.[1] *Aphrissa* was erected in 1873 to contain *statira* and its allies with that species as the genotype. It is clean-cut and related more closely to *Phœbis* than to any other known genus, and together with *Phœbis* forms a group among the rhodocerid pierids rather distantly related to the present existing genera, as has been indicated by Klots in his recent studies of the phylogeny of the Pieridæ. As surmised by Klots in his study of the male genitalia, the origin of *Aphrissa* is probably from a common ancestral form of the present *Phœbis agarithe* and *Aphrissa orbis.* This indication is further strengthened by the color pattern of the females, *orbis* approaching *agarithe* more closely than it does any other species of *Phœbis.* Since the pattern of *orbis* females is the most complete in the genus, we may take it as another indication of the primitive position of *orbis* in the genus.

In this study, I have relied upon the structure of the secondary male and female genitalic organs to a great degree, but have not neglected the usual characters of wing-shape and color pattern. Dr. August Busck of the National Museum suggested to me a method of dissecting and studying the softer parts of the female system and I present it here with his permission. After saponification of fats and the destruction of muscular tissues either by boiling gently for a minute or so in ten per cent caustic potash or by allowing the specimen to soak in such a solution at room temperature for twenty-four hours, it is washed free of excess caustic and the abdomen cleaned of soaps, scales, and the tracheal system by means of a camel's hair brush and very fine dissecting needles. The specimen is then soaked in water containing a few drops of aqueous "mercurochrome" (di-sodium hydro-oxymercury dibromo-fluoroescein) until it is intensely dyed. From this solution the specimen is transferred to a slip of glass, a cut is made the full length of the dorsal surface and any residual tracheal material is removed; then the specimen is placed in a small quantity of full-strength glycerin until thoroughly impregnated. Now, upon placing the dissection in a few drops of clear water upon a slide, the internal organs may easily be studied. The transfer from glycerin to water causes even the finest structures to swell and become fully distended. With a little practice and care excellent preparations may be made. If it is desirable, they can be washed free of glycerin, dehydrated in ethyl alcohol, cleared in xylol, and mounted in balsam. However, in mounts, only the "chitinous" parts will be well preserved. For study, I usually prepare several slides by this method and several to be mounted in lateral aspect in order that fuller knowlledge of the structures and their relations may be gained.

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[1] For a discussion of the generic names that have been used with this group of pierids and their availability, see Brown, F. M., 1929, 'A Revision of the Genus *Phœbis*,' Amer. Mus. Novit., No. 368, pp. 1–3, and Klots, A. B., 1929, Bull. Brooklyn Ent Soc , XXIV, No. 4, pp. 203–214.

The names used in connection with the male organs are according to the diagram on page two of my 'Revision of the Genus *Phœbis*.'[1] The names of the organs of the female are strictly in accord with those used by Dr. Busck and Dr. Heinrich in their publications, in fact, were supplied by Dr. Busck.

The salient characters of the male armature may be briefly set forth as follows:

Valvæ roughly triangular; harpes insignificant; marginal process greatly modified and strongly chitinized; distal process prolonged; annellus rudimentary; juxtæ large and leaf-like. Uncus and tegumen simple; saccus simple and about as long as the combined uncus and tegumen; no dorsal lobe on the tegumen; scaphium absent; vinculum slender. Ædœagus stocky; two sharp, reversed bends toward the distal end which is bifurcate; cornuti[2] absent.

Species of the genus *Aphrissa* differ in the leaf-like structure of the juxtæ when compared with *Phœbis* in which they are filamentous.

KEY TO MALES BASED ON GENITALIA

1.	Marginal process[3] blade-like, serrate-edged	2.
	Marginal process not blade-like	3.
2.	Uncus trifurcate at tip	*hartonia*.
	Uncus simple at tip	*statira* and varieties.
3.	Marginal process a single bent rod	*orbis*.
	Marginal process biramous, fluke-like	*godartiana*.

COLOR KEY TO IDENTIFICATION OF MALES[4]

1.	Ground color of forewing slightly darker than that of hind wing	2.
	Ground color of forewing markedly darker than that of hind wing	3.

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[1] In a letter dated March, 6, 1930, Dr. August Busck says: "I hope you will adhere to the nomenclature as given; this has not been published in full in English, so far as I know, but was adopted in translation, from continental workers."

[2] The cornuti described by me on the ædœagus of *Phœbis* are not true cornuti but merely thorns on the ædœagus. True cornuti are found on the penis proper.

[3] In my revision of *Phœbis* I erroneously called this harpes; Klots calls it a dorsal spine.

[4] For complete key to males of *Phœbis* and *Aphrissa*, see Brown, 1929, Amer. Mus. Novit., No. 368, p. 4.

2. Outer margin of forewing markedly concave, white chalky marginal area extending well into cell. . . . . *hartonia.*
   Outer margin of forewing straight or only very slightly concave, white chalky marginal area barely reaching cell. . . . . *statira* and varieties, 4.
3. Forewing with orange spot on disc. . . . . *orbis.*
   Forewing with yellow spot on disc; hind wings pale tea-color. . *godartiana.*
4. Marginal and discal areas markedly differently color. . . . . .6.
   Marginal and discal areas about the same color. . . . . 5.
5. General ground color white. . . . . *schausi*, *etiolata.*
   General ground color chrome-yellow. . . . . *neleis* varieties.
   General ground color tea-color . . . . *boisduvali* varieties.
6. Discal area greenish yellow. . . . . *statira.*
   Discal area orange. . . . . *jada.*

The females of *Aphrissa* differ from those of *Phœbis* in having the terminal joint of the palpi long and well exposed.

KEY TO THE IDENTIFICATION OF THE FEMALES

1. External margin of forewing straight or nearly so. . . . *statira* and varieties.
   External margin of forewing markedly concave. . . . . .2.
2. Dark marginal spots of hind wing above well developed. . . . . 3.
   Dark marginal spots of hind wing small, not conspicuous. . . . . *hartonia.*
3. Post-medial row of spots of forewing prominent, dark margin of apex ending abruptly. . . . . *orbis.*
   Post-medial row of spots of forewing lacking, dark margin of apex running well down the costa. . . . . *godartiana.*

This key is not particularly good, its weakness being primarily in section 1. However, accurate locality data will practically fix the species name of any specimen, since the ranges of all except *statira* are quite restricted. The plates in Butler's monograph are good, but care must be taken to bear in mind that the orange color is exceedingly intense in many figures.

Unfortunately, I have been unable to make a dissection of the female of *hartonia* because my single specimen had its body destroyed by ants; so, since not all full species have been examined, I can not give a genitalic key for them.

The salient characters of the female genitalia are:

Ovipositor prominent, bi-lobed, ventral lobe twisted and the larger, clothed with spines of varying length; apophyses slender, of moderate length, two in number.

Ninth segment arched, reduced to a narrow bridge across the dorsal area expanding ventrally; the anterior margin curved around the anterior margin of the genital plate.

Genital plate robust, yoke-shaped, broad across the ventral region, tapering and open dorsally; the anterior margin folded back inwardly.

Ostium cover crudely circular, attached to the posterior margin of the ninth segment.

Ducta bursæ chitinized at least two-thirds of its length, a ribbon bent into a trough and connected with the bursæ by a membranous tubular portion. The ducta bullæ originates at the termination of the chitinous portion.

Bursa copulatrix large, ovoid and completely stippled with small chitinous (?) papulæ; a small spheric secondary bursa attached to the anterior end by a slender ducta; signum large and prominent, situated directly at the mouth of the bursa, heavily spined and slightly produced in the middle posteriorly and slightly concave anteriorly.

Ducta bullæ long, gradually expanding into bulla seminalis which enters the oviduct well back and just anterior to the duct leading to the pyriform receptaculum seminis. Cement glands similar, tapering, joined to and dorsal to oviduct about halfway between opening and junction with seminal ducts. The cement glands and receptaculum seminis terminate in long slender filaments. The egg-stocks extend anteriorly and practically fill the body-cavity.

Scent pouch large, ovoid, lying and opening ventral and anterior to the genital plate.

Aphrissa orbis Poey

MALE GENITALIA

Valvæ roughly triangular, the distal process stubby and not hooked; corona bulging, surmounted by a long sharply flexed chitinous rod of uniform diameter tapering abruptly to a point; harpes represented merely by a long thickened fold of chitin, slightly curved and with few spines; annellus and juxtæ longer than in *statira*, juxtæ less distinctly separated at their junction with the annellus. Uncus, vinculum, etc., much as in *statira*. Ædœagus[1] slender, slightly tapering distally with an almost imperceptible reversed curve at that end and terminating in a slender but blunt spur.

FEMALE GENITALIA

It is far more difficult to express verbally the subtle forms and differences found in the female armature than those found in the males. The differences are just as marked but the complexity of the organs almost defies expression. I shall confine myself merely to indicating the outstanding features that may assist in identification; the figures tell the story completely and clearly.

Apophyses short and stubby, about two-thirds as long as the ovipositor. Ventral lobe of the ovipositor much larger than the dorsal lobe. Ninth segment simple and sturdy. The folded anterior margin of the genital plate is rather complexly ridged. There is a marked acute ridge paralleling the margin in its entirety with a spur originating at the angular break in the mid-region that sweeps backward and upward. A less prominent ridge parallels the dorsal portion of the marginal ridge. Two parallel ridges originating on the external portion of the fold of the plate curve on to the interior of the fold and run toward the scar which is in the form of a truncate cone. This scar may possibly be the vestige of a spiracle on the eighth segment. The ostium cover is more or less quadrate in shape, not subcordate as in *statira*. The

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[1] Description of ædœagus from a dissection by Mr. A. B. Klots.

lunulate, pouch-like folds on the seventh abdominal segment, to receive the antero-ventral corners of the genital plate, are narrow, long, and slightly curved.

Of all the strictly Antillean species this insect has the widest range. It is found on Cuba, Isle of Pines, and Hispañola. The male is the most easily distinguished of any in this genus, the bright orange orb on the disk of the forewings giving the species its name. The females are marked like any other female *Aphrissa* but are vivid orange.

Aphrissa godartiana Swainson

MALE GENITALIA

Valvæ roughly triangular with the distal process greatly extended, straight and slender, with a slightly hooked tip; corona broken at its mid-point by a deep cleft and the chitinous marginal process characteristic of the genus, the marginal process resembling the flukes of a whale's tail, the tip of the anterior division occasionally toothed; harpes obscure much as in *statira;* annellus and juxtæ as in *statira* but more delicate. Uncus simple and moderately heavy in structure, the tip not blade-like but trifurcate, tegumen quite setous. Ædœagus heavy and curved as in *statira* but less sharply so; the distal spur is very large and heavy.

FEMALE GENITALIA[1]

Apophyses long and slender, one and one-half to twice as long as ovipositor, lobes of ovipositor about the same size. Ninth segment simple and broad, differing from all other members of the genus and approaching the *Phœbis* type. Genital plate simple as in *statira*, the scar a truncate cone. Ostium cover more or less cordate as in *statira*. The lunulate, pouch-like folds on the seventh segment narrow, short and slightly curved. The chitinous portion of the ducta bursæ is about one-half the total length, less than in any other species in the genus.

A. godartiana is another strictly Antillean species of this genus and is found only on the islands of Hispañola and Porto Rico. It is fairly common but by no means as abundant as *A. statira neleis*. The male resembles *orbis* in color-distribution but the area so vividly orange in *orbis* is lemon-yellow in *godartiana*.

Aphrissa hartonia Butler

MALE GENITALIA

Valvæ subtriangular; dorsal margin irregular and adorned with a spiny, chitinous, foot-shaped marginal process; outer margin smoothly undulating, terminating in a slender prolonged distal process; annellus short, terminating in two leaf-like juxtæ; harpes an inconspicuous lunulate fold. Uncus slender, sharply curved, almost as long as vinculum. Ædœagus moderately stout with a slight reversed curve toward the distal end which is armed with a short blunt spur.

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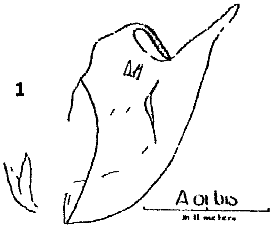
[1] A single female specimen of this species was received and dissected too late to include a drawing of the dissection.



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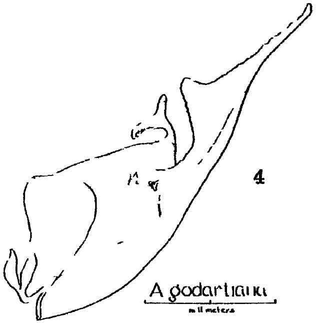

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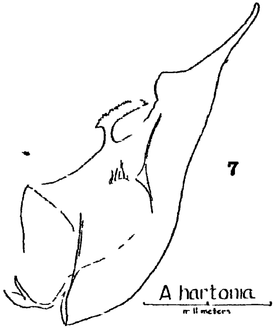

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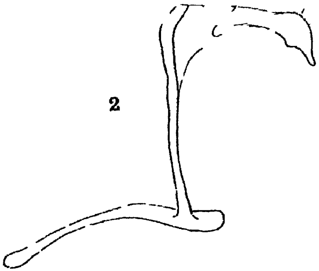

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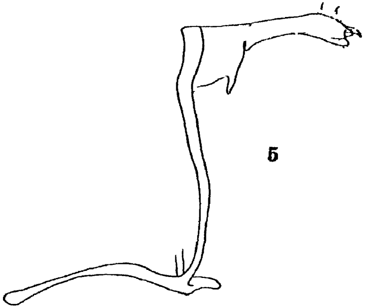

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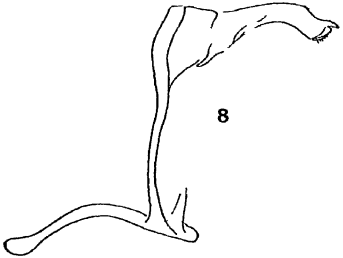

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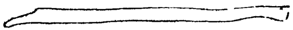

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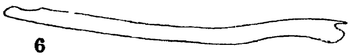

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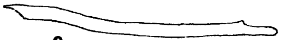

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Fig. 1. Valva of *Amphrissa orbis*.
Fig. 4. Valva of *A. godartiana*.
Fig. 7. Valva of *A. hartonia*.

Fig. 2. Uncus, Etc., of *A. orbis*.
Fig. 5. Uncus, etc., of *A. godartiana*
Fig. 8. Uncus, etc., of *A. hartonia*.

Fig. 3. Ædœagus of *A. orbis*.
Fig. 6. Ædœagus of *A. godartiana*
Fig. 9. Ædœagus, of *A. hartonia*.

This species superficially resembles *statira* which it approaches structurally more closely than any other. It is confined to the island of Jamaica where it is apparently local in distribution. The only specimens of which I actually know are in the British Museum and in my own collection.[1] Both Dr. Schaus, of the National Museum, and Mr. Watson, of The American Museum of Natural History, failed to get it when collecting there. Mr. N. D. Riley has told me that Butler's type material is the only lot in the British Museum. The "*statira*" of Kaye's Jamaican list is *hartonia.*

Aphrissa statira Cramer and forms

MALE GENITALIA

Valvæ roughly triangular, dorsal margin irregular and adorned with a subtriangular chitinous comb-like marginal process, usually with a small secondary process situated slightly anterior to it, both originating from the inner surface of the valvæ; the outer margin of the valvæ terminating dorsally in an incurved spur heavily chitinized at the tip, the inner margin of this process is very irregular; the top of the comb either convex or concave, irregularly toothed. Annellus very short. juxtæ broad, long and leaf-like; surface of the valvæ covered with long bristly hairs, shortest on the caudal margin. Uncus simple, lightly chitinized, terminating in a single incurved blade-like tip, armed with a few delicate hair-like spines. Vinculum moderately long and slender. Saccus about as long as vinculum, slender. Ædœagus heavy, with a reverse curve at the distal end; tip armed with a very short spur directed parallel to the length.

A series of about thirty dissections shows no consistent variation among the following named forms: *statira, neleis, wallacei, boisduvali, etiolata, jada, felderi, butleri.* The marginal process shows the most variation but this is not consistent for any form.

FEMALE GENITALIA

The apophyses in all forms of *statira* are long and slender, about as long as the ovipositor itself. The ninth segment and the genital plate are both simple. The anterior margin of the genital plate usually shows dorsally a slight twist and fold. The scar on the plate is rather simple and in the form of a hollow truncate cone and medially situated. The lunulate folds on the seventh abdominal segment are small and sharply curved.

The specimen figured is form *neleis* from Cuba. There is some variation, as might be expected, but it is not consistent for any form or geographic range.

An analysis of approximately three hundred and fifty specimens from over the entire range in the collections of The American Museum of Natural History, the Museum of Comparative Zoölogy, the National

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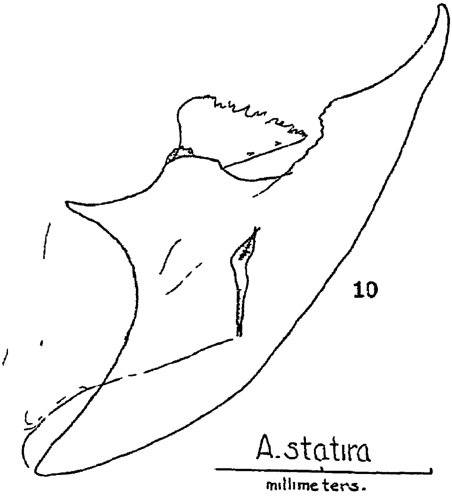
[1] One male now deposited at the National Museum and several males and a female at the American Museum.



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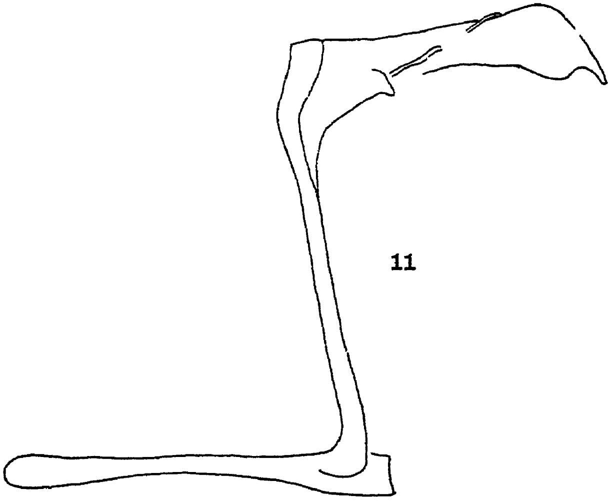

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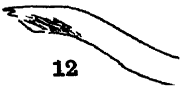

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Fig. 10. Valva of *Amphrissa statira.*
Fig. 11. Uncus, etc., of *A. statira.*
Fig. 12. Ædœagus of *A. statira.*

Museum, Cornell University, and the author, encompassing all of the named forms and varieties, is here summarized.

A. statira and its forms are found throughout the American tropics and the bordering temperate regions, the nymotypical form is common in northern South America completely across the continent and everywhere except in the decidedly temperate and colder mountain ranges; of this form, *evadne* Godart and female form *pseudomas* Giacomelli, of which I have a metatype, are synonyms. As in most yellow pierids, there are albinic female forms, *fabia* Fabricius (*hyperici* Sepp) may be applied to the white females from this region. Recently Forbes and Avinoff have named white males. Forbes' specimens are from South America and Avinoff's from Guatemala. It is of interest that in these forms the patches of sex-scales in the overlapping areas of the wings are reduced to a few scales or are totally absent. This absence of scales is found, but very rarely, in otherwise normal *statira* and in the totally yellow form *wallacei* Felder from South America. I cannot agree with Forbes in believing that it is a distinct species; everything points otherwise. I have seen a complete series showing every intergrade from normal scale-patches to none, and the genitalia of the males, which differ markedly in the species of this genus, are identical in the case of *etiolata* Forbes[1] and *statira*. Forbes' specimens show considerable yellow-green coloring at the base of the wings, and, since he emphasized the lack of sex-patches in his description, his name should be applied to those specimens that totally lack the sex-scales, regardless of coloration. The name *schausi* Avinoff I apply to the pure white males. Poey has named the *statira*-like specimens from Cuba *zulema*.

There occurs an interesting variation in each of the three color forms found with the typical form. Specimens taken in the northern or Gulf region either lack or have only a few black scales representing the apical margin of the forewing, while those from southern Central America and South America have marked black apical margins. The name *boisduvali* Felder applies to the tea-colored form from South America with the black marginal marking. The specimens of this color from the northern part of the range have not been named.

The form in which the yellow extends to the margin has been usually called *neleis* Boisduval; this name must be restricted to the West Indian race as it was described from Cuban specimens which in the female differ markedly from the mainland specimens. The typical *neleis* females have the black apical margin broken into patches and have a marked submarginal row of spots extending from the apex about half-way down the wings; beneath, the markings are more intense than in the mainland form. However, males from Cuba are colored more like those from the mainland, with the underside of the hind wings tea-color, while in the Haitian males it is bright yellow. The name *wallacei* Felder is reserved for the South American yellow form which differs from the Gulf region form, *butleri* Scudder, in the manner noted above. Neumoegen described a form of the *neleis* type from Florida and called it *floridensis*. Whether this name should stand or sink to *butleri* Scudder or *neleis* Boisduval, I am not sure, but I feel that it may stand for a Florida race. It is materially larger and much less intensely marked than any other form. I have seen some twelve or fifteen specimens and they are consistent in this respect. The females that I have seen correspond with the female type and are albinic. I know it from only two localities in Florida; Indian River (the type material), and a small lot from Fort Worth in the A. T. Slosson collection at The American Museum of Natural History.

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[1] Four specimens totally lacking the sex-patches have been examined: one of these was marked by Forbes as *etiolata* and is mentioned in the original description; two others are identical with it; the fourth is typically *statira* as to color but totally lacks the patches.

The third color form is much more rare in collections. In it the predominating color of the wings is decidedly orange, though not so vivid as both Butler's and Sietz' figures would indicate. The margined South American form is *jaresia* Butler and the marginless northern race is *jada* Butler, of which I have seen and dissected but a single male from the National Museum collection.

I have come to the conclusion that all of the varieties are valid and that the names listed below are necessary to recognize properly the facts as they appear to be. It is to be expected that this most recent development of these very recently evolved genera (*Phœbis* and *Aphrissa*) of rhodocerid pierids should show much diversification under varying environmental conditions. Doubtless, as time passes, many of these will ultimately develop into full-fledged species.

Aphrissa statira neleis female form **poeyæ**, new form

Above.—Pure white with a very faint flush of pale yellow at the base of the hind wings. Marginal brown markings of the forewings reduced to a minimum. Discal spot on the forewings of normal size and color. Hind wings immaculate.

Below.—Faintly flushed with pale lemon-yellow. Maculation of both wings faint and of pink-brown scales; discal spots without any silver scaling.

Expanse.—53 mm.

Holotype.—Female; Cuba (Wm. Schaus); in United States National Museum, Washington, D. C.

Table of Described Forms of *Aphrissa statira*

Race	*A. s. statira*	*A. s. jada*	*A. s. floridensis*	*A. s. neleis*
Range	S. and C. America	North America	Florida	West Indies
Typical white and lemon-yellow form	*statira* Cramer	(nameless)		f. *zuelma* Poey
	f ♀. *fabia* Fabricius	f ♀. *stalba* Brown		f ♀. *poeyæ* Brown
	ab ♂. *etiolata* Forbes	ab ♂ *schausi* Avinoff		
Yellow form	f. *wallacei* Felder	f. *butleri* Scudder	*floridensis* Neumoegen	*neleis* Boisduval
Buff form	f. *boisduvali* Felder	(nameless)		
Orange form	f. *jaresia* Butler	*jada* Butler		

Aphrissa statira jada female form **stalba,** new form

Above.—White, sometimes with a slight greenish cast; some buff at the base of the hind wings. Forewings with a black-brown margin at the apex and continuing along the outer margin as a row of spots at the terminal of the nervures; these spots may be contiguous toward the apex, occasionally represented by only a few scales. Discal spot on the veins between M and M_2. Hind wings immaculate.

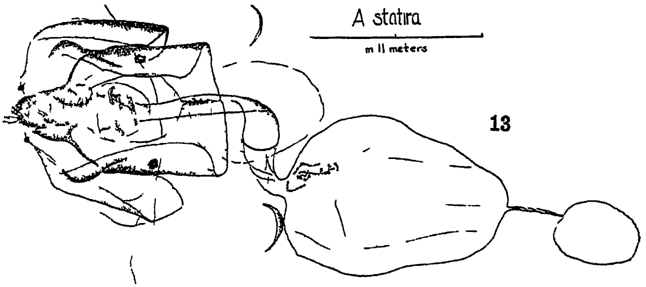
Below.—Pearly white in anal area of forewings and buff to light cadmium-yellow at the base of both wings. Normal maculation but reduced to a few scales in each spot. Discal spot and maculation of apex of forewing prominent.

Holotype.—Female; Truxillo district, Honduras; collected by F. C. Nicholas; No. 18314, in collection of American Museum of Natural History.

The major portion of the material used for this revision is in The American Museum of Natural History and with my own collection [now deposited there] constitutes about nine-tenths of all the specimens examined. I wish to express my thanks to Mr. Frank E. Watson of that institution for many hours of his time and kind counsel.

Abbreviations Used in Diagram of Female Organs

a.c. —alimentary canal
ap —apophysis
b.c. —bursa copulatrix
b.s. —bulla seminalis
c.g. —cement glands ("glandulæ sebaceæ") (actually dorsal to oviduct)
d.bul. —ducta bullæ
d.bur. —ducta bursæ
e.s. —egg-stocks
g.p. —genital plate
o.a.c.—opening of alimentary canal
o.c. —ostium cover
o.ov.—opening of oviduct
op. —ovipositor
ov. —oviduct
r.s. —receptaculum seminis
s.b. —secondary bursa ("accessory organ")
s p. —scent pouch
spt. —lobe near the mouth of the receptaculum
9 —ninth segment ("collar")



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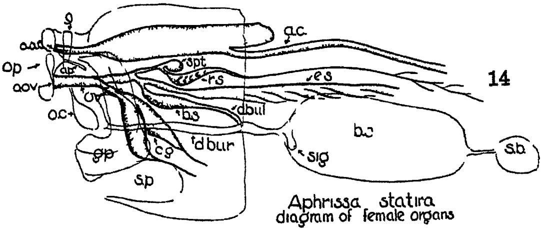

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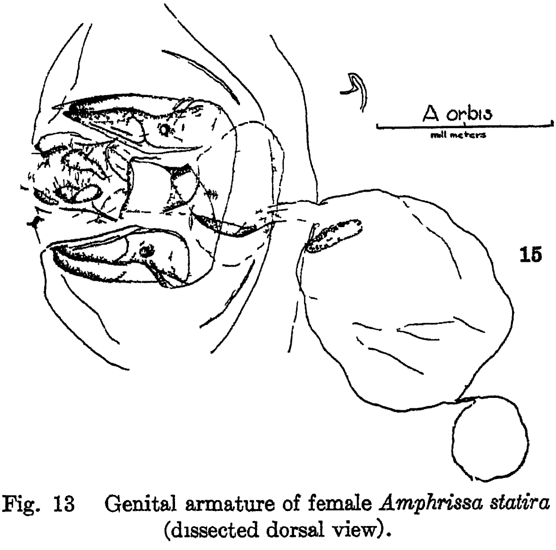

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Fig. 13 Genital armature of female *Amphrissa statira* (dissected dorsal view).

Fig. 14. Genital armature of female *A. statira* (diagrammatic lateral view).

Fig. 15. Genital armature of female *A. orbis* (dissected dorsal view).

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etiolata (*statira*) Forbes, 1927, Ann. Ent. Soc. Amer., XX, p. 479.
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floridensis (*statira*) Neumoegen, 1891, Can. Ent., XXIII, p. 122.
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hyperici (*statira*) Sepp, 1848, 'Surinam. Vlinders,' I, p. 45, Pl. xix.
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pseudomas (*statira*) Giacomelli, 1911, An. Soc. Cien. Argentina, LXXII, p. 21.
schausi (*statira*) Avinoff, 1926, Ann. Cargnegie Mus., XVI, p. 360.
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wallacei (*statira*) Felder, 1862, Wein. Ent. Mon., VI, p. 6.
zulema (*statira*) Poey, 1851, 'Mem. Sobr. Hist. Nat. Cuba,' I, p. 198.

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[1] The names in brackets refer to the species under which the form is discussed.

[2] This is the usual date given for the 'Enc. Méth.,' IX, and is probably satisfactory for this page reference. See Riley, N. D., Trans. Ent. Soc. Lond., 1926, p. 231.

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THE GENUS *LASIA* (DIPTERA, CYRTIDÆ) IN NORTH AMERICA, WITH DESCRIPTIONS OF TWO NEW SPECIES

By J. Bequaert[1]

The discovery in Yucatan of an apparently undescribed species of *Lasia* has led me to collect a few notes on this genus, which is represented by very few specimens in most collections. I have been able to examine the types of all the species known from north of Panama. The holotype of *L. klettii* was studied at the Museum of Comparative Zoölogy, Cambridge, Mass.; one of the two cotypes of *L. scribæ* was very obligingly sent to me by Dr. Walther Horn; while the holotypes of *L. colei* and *L. rostrata* were seen at the U. S. National Museum.

Lasia Wiedemann

Lasia Wiedemann, 1824, 'Analecta Entomologica,' p. 11 (monotypic for *Lasia splendens* Wiedemann, 1824); 1828, 'Aussereurop, Zweifl. Ins.,' I, p. 329. Cole, 1919, Trans. Amer. Ent. Soc., XLV, p. 27.

Panops Wiedemann, 1830, 'Aussereurop. Zweifl. Ins.,' II, p. 18 (in part). Bigot, 1889, Ann. Soc. Ent. France, (6) IX, pp. 314 and 316. Kertész, 1909, 'Cat. Dipt.,' IV, p. 8 (in part). Not of Lamarck.

Vertexistemma Bigot, 1856, Ann. Soc. Ent. France, (3) IV, pp. 65, 87 (monotypic for *Panops ocelliger* Wiedemann, 1830).

Verticistemma Bigot, 1859, Ann. Soc. Ent. France, (3) VII, p. 210 (emendation of *Vertexistemma*).

Lasia was rather poorly defined by Wiedemann, the original diagnosis containing, for instance, the erroneous statement: "ocelli nulli." The drawing which he first gave of the wing of *Lasia splendens* (1824, 'Analecta Entomologica,' Pl., fig. 3) was inaccurate. This figure was, moreover, corrected in a later work (1828, 'Aussereurop, Zweifl. Ins.,' I, Pl. iv, fig. 3*d*), where Wiedemann placed *Lasia* among his Bombylarii, a group corresponding fairly well to the present family Bombyliidæ, although it also contained some Nemestrinidæ. Two years later (1830), Wiedemann described two additional South American species of *Lasia*, but placed them in *Panops* Lamarck, among his Inflatæ, which group corresponds to the present family Cyrtidæ. One of these supposed new species, *Panops flavitarsis*, appears to be identical with his earlier *Lasia splendens*. The figures which he now gave of the head, antennæ and wing of *P. flavitarsis* (Pl. IX, figs. 2*a*-c), seem to be correct in all essential points.

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The unfortunate confusion between *Lasia* and *Panops*, inaugurated by Wiedemann himself, was perpetuated by later authors, notably by Kertész, who united the two genera in his 'Catalogue of the Diptera of the World' (1909). *Panops* Lamarck (1804, Ann. Mus. Hist. Nat. Paris, III, p. 263), however, is strictly Australian, and differs conspicuously from *Lasia* in the shape of the face, where the antennæ are placed close to the vertex, as well as in the eyes being bare and touching each other below the antennæ only. Hardy (1922, Papers Proc. Roy. Soc. Tasmania for 1921, p. 79) recognizes only two species. *Mesophysa* Macquart (1838, 'Dipt. Exot.,' I, 2, p. 166; misspelled *Mesophyza* by Bigot, 1889, Ann. Soc. Ent. France, (6) IX, p. 315) is a synonym of *Panops*, as shown by Schiner (1868) and Hardy (1922). It was based upon two species: *M. scapularis* Macquart (apparently a synonym of *Panops flavipes* Latreille) and *M. marginata* Macquart (generally regarded as identical with *Panops baudini* Lamarck, the genotype of *Panops*). Brunetti (1926, Ann. Mag. Nat. Hist., (9) XVIII, p. 580) selected *scapularis* as the type of *Mesophysa*. His interpretation of *Panops* is, however, confusing, since he places *baudini* (the genotype of *Panops*) in *Mesophysa*, while he states that Kertész was in error in sinking *Mesophysa* under *Panops*. Brunetti must have been misled by Bigot's (1889) generic key of the Cyrtidæ.

That *Panops* and *Lasia* are generically distinct was first recognized by Schiner (1868, 'Novara Reise, Zool.,' II, Abt. 1, Vol. B, Dipt., pp. 141–142) and, it would appear, independently by Westwood (1876, Trans. Ent. Soc. London, p. 508). *Lasia* has been defined correctly and fully by Cole (1910). It is exclusively American and is recognized by the antennæ being placed at or below the middle of the head, far from the ocelli, and by the eyes being densely pilose and touching each other only above the antennæ. In all the species I have seen, the posterior ocelli are distinct; but the anterior ocellus is either very small and hidden within a slit-like depression of the vertex, or apparently lacking. Cole writes that the legs have "a tooth-like apical spur above and a sharp projection below." This statement, I surmise, refers to the tibiæ. I can find no trace of a true, articulated apical spur on the tibiæ of any of my specimens; but in some species the outer apex of the tibia is drawn out into a strong point, while the inner apex is sharply angular. Cole adopts Verrall's (1909, 'British Flies,' V, p 450, fig. 259*A*) interpretation of the venation of *Lasia* and states that it is very close to that of the Nemestrinidæ. He also writes(1919, p. 8)that "in *Hirmoneura* the discal cell is absent, but otherwise the venation corresponds to *Lasia.*" After examining the venation of many species of Nemestrinidæ, belonging to nearly all the known genera, I am unable to find any particular resemblance to *Lasia.* Nor do I see any reason why, in *Hirmoneura,* the large cell in the center of the wing, between the second basal cell and the first posterior cell and below the first basal cell, should not be regarded as the true discal cell, corresponding to the cell of that name in Cole's drawing of the wing of *Lasia* (1919, Pl. I, fig. 1). Moreover, there is no trace of a diagonal vein in *Lasia,* while the division of the first basal cell, characteristic of *Lasia,* is not found in *Hirmoneura,* nor in any other nemestrinid. Turning to the characters of the head, thorax and abdomen, which in my opinion are much more important for tracing true relationships than details of the venation, I cannot see that the peculiarities of *Lasia* find their counterpart anywhere among the Nemestrinidæ.

For the purpose of this paper, I shall adopt Verrall's and Cole's interpretation of the venation of *Lasia,* as shown in Cole's Pl. I, fig. 1 (1919). In a later paper (1919, Ent. News, XXX, Pl. XI, fig. 2), Cole has given an interpretation of the wing of *Lasia* in the terms of the Comstock-Needham system.

Lasioides Collado (1928, Eos, IV, 1, p. 57.—Monotypic for *Lasioides peruanus* Collado, *loc. cit.,* p. 59, Fig. 1; Peru) is, as noted by the author, closely allied to *Lasia,* from which it differs only in the very long and wide, compressed and somewhat falcate third antennal segment, and in the very small head, not or hardly visible from above. Since the only known specimen of *L. peruanus* is a female, while most specimens of *Lasia* in collections are males, there is a possibility that these differences are sexual rather than generic. Collado calls attention to Philippi's description of the antenna of the Chilean *Lasia rufovestita* (Blanchard), which, if correct, would place that species also in *Lasioides.*

Brunetti (1920, 'Fauna Brit. India, Diptera Brachycera,' I, p. 164) described a *Lasia aurata* from India. But his accounts, both of the genus and the species, show conclusively that he misunderstood *Lasia,* even to the extent of placing it in the wrong subfamily. His Indian insect is certainly not congeneric with the American species of *Lasia,* although without a study of the specimen it is impossible to suggest where it belongs.

Disregarding *L. rufovestita*, which, as mentioned above, is probably a *Lasioides*, twenty species are at present recognized in the genus *Lasia*, two of them being described in this paper. There is, however, a possibility that some of the so-called species, listed as distinct in the catalogues, will prove to be synonyms, when they are critically compared. Chile appears to be the chief center of distribution, with eleven species, some of which are said to extend into Argentina and Brazil. Of the remaining nine species, three are found in Brazil, one in Ecuador, four in Central America, and one in the southwestern United States.

In my experience, the most reliable specific characters of *Lasia* are exhibited by the shape of the antennæ, the structure of the frontal or supra-antennal triangle (which corresponds to the "subcallus" of the Tabanidæ, called by Szilády the "antennal segment," a most unfortunate term), and the sculpture of the integument. Some peculiarities of the venation are also of value, but most of them are too variable to be trusted. The color of the integument, especially the different hues of bluish, green, violet, purple, or copper, as well as the presence or absence of metallic stripes on the thorax, appear to be rather unreliable, but the color of the tarsi seems to be of importance. Likewise the color of the pilosity cannot be depended upon to any great extent. Unfortunately, most published descriptions emphasize the color characters, thus often rendering positive identification mere guesswork.

In the following key of the five species known from north of Mexico, I have given prominence to the characters of structure.

1.—First and second longitudinal veins and upper branch of third ending separately in the costa at a considerable distance from one another. Antenna slender, the third segment obtuse at the tip. Integument very shiny, with microscopic sculpture. Thorax and abdomen mostly golden green or purplish, densely covered with mostly light yellow or partly dark brown pile. Tarsi yellow. Length, 8.5 mm. (Costa Rica)........ *L. rostrata* Aldrich.

First and second veins coalescent before the tips; upper branch of third vein ending in the costa at or close to the tip of the combined first and second. Abdomen with short, scattered hairs or almost bare. Larger species (12 to 18 mm.)........................2.

2.—Legs black, with pale yellow tarsi. Antenna small and slender, the third segment slender and very gradually attenuated toward the pointed apex. Body shiny, with very fine puncturation. Thorax and abdomen bright golden-green, the posterior part of the abdomen more coppery; pile of thorax yellow, rather dense, with some black hairs posteriorly and on the scutellum; abdomen distinctly pilose in side view, the pilosity mixed yellowish and black. Length, 12.5 mm. (Costa Rica).............. *L. colei* Aldrich.

Legs entirely black. Thorax with very short, sparse pilosity. Larger species (14 to 18 mm.)..3.

3.—Integument coarsely sculptured; the individual punctures deep, large, close together; in the center of the first and second tergites they are crowded, so that the intervening spaces are narrower than the punctures. Anterior third of thoracic dorsum distinctly, though irregularly, striate on the sides. Third antennal segment elongate spindle-shaped, rather suddenly narrowed into the short, sharp apex. Length, 14.5 mm. (Yucatan). *L. yucatanensis*, n. sp.

Integument moderately sculptured; the individual punctures small, superficial and far apart; in the center of the first and second tergites the intervening smooth spaces are wider than the punctures. Anterior third of thoracic dorsum not appeciably striate on the sides . . . . .4.

4.—Upper part of frontal triangle very slightly raised, in the middle into a low, simple tubercle. Third antennal segment very gradually narrowed into a long point (Fig. 1*E*). Abdomen almost bare, even on the hind part of the third tergite. Pleura and humeri mostly with black pile. Length, 16 mm. (Arizona and possibly New Mexico) . . . . *L. klettii* Osten Sacken.

Upper half of frontal triangle saddle-shaped, with a deep, longitudinal depression separating two low tubercles. (Antenna unknown.) Abdomen more distinctly hairy; the pile short and black on first and second tergites, much longer and grayish yellow on the third. Pleura and humeri mostly with yellowish pile. Length, 17 to 18 mm. (Guatemala) . *L. scribæ* Osten Sacken.

Lasia rostrata Aldrich

Lasia rostrata Aldrich, 1927, Proc. U. S. Nat. Mus., LXXII, Art. 9, p. 2 (♂ ♀; Higuito, San Mateo, Costa Rica).

This species is known only from the holotype (♂) and the supposed allotype (♀). Aldrich has expressed some doubts as to the conspecificity of the male with the specimen which he regards as the female, so that he did not venture to label the latter as the allotype. I believe, however, that these two insects certainly belong to one species, since they agree in all really important structural characters. I am not quite certain that they represent different sexes. The differences in color of integument and pilosity I regard as unimportant. As for the relative length of the proboscis, a careful study of a number of specimens of *Lasia* has convinced me that the individual insect is able to extend or contract this organ. The basal portion of the labium is built in a peculiar fashion, enabling a certain amount of contraction and extension of that part of the proboscis. The mandibles, on the other hand, are completely rigid, and it might be more correct to measure the proboscis along these organs, were it not that the tips of the mandibles are usually enclosed by the labium. Nevertheless, most specimens of *Lasia* show distinctly that the labella extend far beyond the tips of the mandibles.

In *L. rostrata*, the two posterior ocelli are present, though difficult to see; frontal triangle flat above, without hump or depression, strongly raised below, near the antennal sockets; antenna long and slender, the first segment completely free from the socket, a little over half the length of the second, the third nearly parallel-sided, about seven times the length of the second and of about the same width, broadly and bluntly rounded off at the apex. The species is related to *L. rufipes* Westwood, of Chile, which has the frontal triangle of the same shape, but has the third antennal segment much more pointed, while the legs are mostly or entirely yellowish.

Having seen no specimen which I can refer with certainty to *L. splendens* Wiedemann, I am unable to discuss the relations of *L. rostrata* to that species; but, if Wiedemann's figure of the antenna is to be trusted, the two species are certainly distinct. It should be noted, however, that Wiedemann's figure of the antenna of his *L. flavitarsis* (usually regarded as a synonym of *L. spendens*), is again very different.

Lasia colei Aldrich

Lasia colei Aldrich, 1927, Proc. U. S. Nat. Mus., LXXII, Art. 9, p. 1 (♂; Higuito, San Mateo, Costa Rica).

This species also is known only from the holotype. The antennæ are more slender and much more pointed than those of *L. yucatanensis*, being more like those of *L. klettii:* the first segment is mostly hidden in the socket. Posterior ocelli quite distinct. Frontal triangle very slightly and evenly swollen throughout, without tubercle or depression in the upper part and not raised near the antennal sockets.

Lasia scribæ Osten Sacken

Lasia scribæ Osten Sacken, 1887, 'Biol. Centr.-Amer., Dipt.,' I, p. 166 (♂; Guatemala). Aldrich, 1905, 'Cat. North Amer. Dipt.,' p. 221. Cole, 1919, Trans. Amer. Ent. Soc., XLV, p. 30 (copy of description only).
Panops scribæ Kertész, 1909, 'Cat. Dipt.,' IV, p. 10.

Osten Sacken's description was based upon two specimens. The whereabouts of one of these cotypes is unknown to me; the other, now part of the collections of the Deutsches Entomologisches Museum, at Berlin-Dahlem, has been sent to me for study by Dr. W. Horn. It is the specimen mentioned by Osten Sacken as lacking the end of the abdomen and as having the violet reflections of the thorax in the shape of stripes.

This cotype resembles superficially the holotype of *L. klettii.* No great importance should perhaps be attached to the slight differences in the hue of the integument and in the color of the pile. I believe, however, that the peculiar shape of the frontal triangle is a specific character of value; perhaps also, the sculpture of the labrum. The antennæ, when they are known, may furnish additional differences.

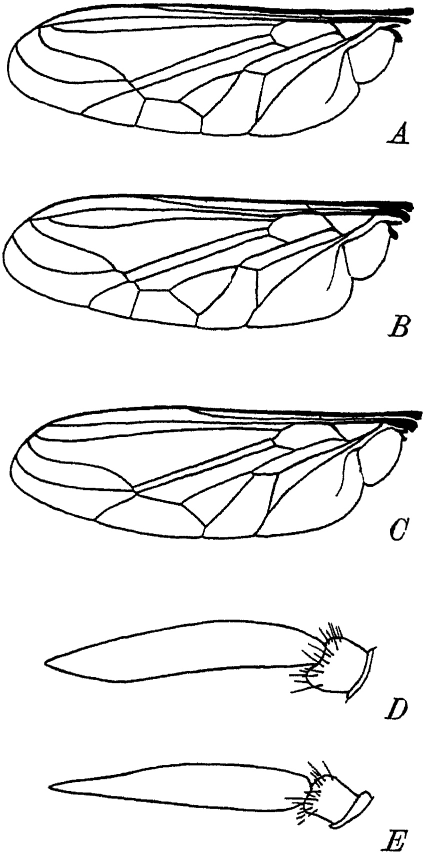

Fig. 1. *A*, left wing of *Lasia scribæ* Osten Sacken, cotype; *B*, left wing of *Lasia yucatanensis*, new species, holotype; *C*, left wing of *Lasia ecuadorensis*, new species, holotype; *D*, outer side-view of left antenna of *L. yucatanensis*; *E*, outer side-view of left antenna of *Lasia klettii* Osten Sacken, holotype.

The venation of the cotype seen is the same in both wings (Fig. 1*A*). It shows the following peculiarities, when compared with Cole's drawing of the wing of *Lasia* (1919, Pl. I, fig. 1). The second vein ends in the first a considerable distance from the costa (more than twice as far as shown in Cole's figure). The upper branch of the third reaches the tip of the second, just before the latter enters the costa. The two branches of the fork of the third are fused at the base, so that the second submarginal cell is shortly petiolate. The fourth vein forms one straight line with its upper branch, so that the second upper basal cell is closed by a simple cross-vein and not by three sections as in Cole's figure. The fourth posterior cell is shortly petiolate at the base. Although some of these peculiarities are not found in the type of *L. klettii*, I do not regard them as of specific value.

As the tip of the abdomen is lacking, the true length of this cotype cannot be determined; the proboscis likewise appears to be broken. but what is left of it extends slightly beyond the apex of the body. The wing is 16 mm. long.

The specimens from New Mexico and Mexico referred doubtfully by Cole to *L. scribæ* will be discussed under *L. klettii*.

Lasia klettii Osten Sacken

Lasia klettii OSTEN SACKEN, 1875, in Wheeler's 'Rept. Expl. Surveys West of 100th Meridian,' V, Zool. p. 805, Figs. 1–3 (no sex given; Apache Camp, Arizona); 1877, Bull. U. S. Geol. Geogr Survey, III, 2, p. 278; 1878, Smithson. Miscell. Coll., No. 270, p. 99. ALDRICH, 1905, 'Cat. North Amer. Dipt.,' p. 221. COLE, 1919, Trans. Amer. Ent. Soc., XLV, p. 29.

Panops klettii KERTÉSZ, 1909, 'Cat. Dipt.,' IV, p. 9.

The holotype of *L. klettii* was collected by Francis Klett in September 1873, at Camp Apache (now called Fort Apache), in Apache County, not very far from the border of New Mexico. It appears to be a male. In general aspect it is so much like my very fresh specimen of *L. yucatanensis* that I believe only little of the original pubescence has been lost through preserving the insect in alcohol.

Osten Sacken's woodcut of the venation (Fig. 3) applies to the left wing only, although his Fig. 1 shows the venation alike in both wings. In the right wing the upper branch of the fourth vein is simple at the tip, not bifurcate as in the left wing; while the projecting stump on the upper branch of the fork of the third is barely indicated. These two peculiarities of the venation are therefore mere abnormalities. In Osten Sacken's Fig. 1, the dorsum of the thorax shows two incomplete stripes which are not mentioned in the description. On the specimen they are merely slightly depressed areas, rather difficult to see and not different in color from the remainder of the dorsum; most probably they are accidental and caused by the method used to preserve the insect.

Williston (1886, Trans. Amer. Ent. Soc., XIII, p. 294) referred to *L. klettii* (misspelled *kletii*) two specimens from New Mexico, and I am inclined to regard his identification as correct. Cole has evidently seen the very same specimens, now at Kansas University, which obtained most of Williston's personal North American collection (except Syrphidæ and some duplicates). Disregarding color differences, which, as stated above, I do not regard as reliable, there is nothing in Cole's additional notes that might not be found in *L. klettii*. Unfortunately the antennæ are only incompletely described and the structure of the frontal triangle is unknown. It should be noted that the type locality of *L. klettii*, in Arizona, is close to the border of New Mexico.

Cole also referred doubtfully to *L. scribæ* a poorly preserved fly from the old C. V. Riley Collection, now at the U. S. National Museum. This specimen lacks the antennæ. The sculpture is like that of *klettii*, and the presence of long black pile on the pleura and humeri would also seem to indicate that species, and not *L. scribæ* as Cole suggested. The shape of the frontal triangle, with the raised tubercle, is like that of the type of *L. klettii*.

Lasia yucatanensis, new species

Large, metallic blue, moderately shiny, with slight purplish reflections, sparsely pilose. Puncturation coarse. Legs black. Third antennal segment gradually narrowed into the short, sharp apex.

MALE.—Head moderately large, hemispherical. Eyes densely covered with short, light yellow pile, contiguous over about the upper half of the head, between the small ocellar tubercle and the short frontal triangle. Ocellar tubercle low, broadly triangular, with the two posterior ocelli large and distinct, the anterior ocellus minute and hidden within a slit-like depression. Antennæ (Fig. 1*D*) narrow; first segment very short, mostly hidden within the antennal socket; second almost square in side view, with rounded upper and lower angles, about as broad as long; third about five times the length of the second, slightly flattened from the sides, in profile elongate spindle-shaped, with the lower margin straighter than the upper one, gradually narrowed toward the base and more suddenly toward the short and sharp apex. Proboscis very long and slender, longer than the body, the labium ending in two very long and narrow labella; labrum (covering the base of the proboscis in the deeply excavated face) smooth, without striation or visible punctures, with a superficial median groove. Frontal triangle very slightly raised in the middle above, without median depression. Thorax and abdomen broad and very convex, forming in profile an even curve dorsally and an almost straight line ventrally. Wing venation (Fig. 1*B*) essentially as in the allied species; curiously enough it duplicates almost exactly that of the cotype of *L. scribæ* which I have studied (Fig. 1*A*).

Integument densely covered with moderately coarse punctures (except on the head) which almost everywhere are larger than their smooth intervals; this is especially striking in the center of the first and second tergites. In addition to the punctures, the sides of the anterior third of the thoracic dorsum show a series of irregular wrinkles, which tend to radiate from the hind angles of the humeri. Pleura coarsely, transversely striate. Fourth and fifth tergites and all the sternites with a fine, irregular, transverse striation.

Body very little hairy, almost bare dorsally, especially on the abdomen. Occiput with some short, grayish-yellow pile. Dorsum of thorax with scattered, short, yellowish hairs which are denser and longer on the anterior margin and on the humeri, and still more so on the pleura and sternum. Hairs of the abdominal tergites very short, pale yellowish, as sparse on the third tergite as elsewhere. Legs with short yellowish hairs, somewhat silvery on the outside of the tibiæ, mixed with blackish pile on the femora and with russet on the tarsi.

Body metallic blue, with slight greenish or purplish reflections, especially on the dorsum of the thorax; under side of the abdomen violet. Antennæ black, with the third segment narrowly yellow at the base. Proboscis black. Legs black; apices of the femora and under side of tarsi slightly brownish; claws black. Wings slightly and uniformly smoky; squamæ blackish; halteres black, with yellowish white stalk.

Length, 14.5 mm.; of wing, 13 mm.; of proboscis, 15 mm.

YUCATAN.—Chankom, one male, holotype, June 20, 1929 (J. Bequaert collector; Mus. Comp. Zool.).

This striking insect was hovering near me as I was walking through a patch of low, scrubby forest, on a moderately sunny morning, after several days of rain. Its behavior was so much like that of the common green bee, *Euglossa cordata* (Linnæus), found in the same locality, that I was completely deceived by it, until the fly came to rest on a leaf. The resemblance between the two insects, though extraordinary in life, is by no means as striking when they are pinned side by side after death.

The coarser puncturation gives *L. yucatanensis* a much duller appearance than *L. scribæ* and *L. klettii*. These three species are closely allied and form in the genus *Lasia* a distinct group characterized by the very large size, the peculiar ending of the second and upper branch of third veins, and the sparse pilosity. *L. colei*, however, forms the transition between this group and the more usual type of *Lasia*, so that it does not seem worthwhile to separate the group into a distinct subgenus.

Lasia ecuadorensis, new species

Small, metallic green and very shiny, with dense and long pilosity. Puncturation extremely fine. Legs black. Second branch of fourth vein absent. (Antennæ unknown.)

MALE.—Head rather small, hemispherical. Eyes densely covered with very long, pale yellow pile, contiguous over about the upper half of the head, between the very small ocellar tubercle and the very short frontal triangle. Ocellar tubercle very low, broadly triangular, with the two posterior ocelli small but distinct, the anterior ocellus invisible. Antennæ: first segment small but free from the antennal socket, about as long as wide at apex; second only a little longer than the first, but more swollen; (third broken off). Proboscis much longer than the body, very slender, the labium ending in two very long and narrow labella; labrum entirely smooth.

Frontal triangle with a depression on each side of the middle, defining an anterior transverse swelling which continues behind into an upper, low tubercle. Thorax and abdomen broad, moderately convex dorsally, forming ventrally a straight line in profile. Wing venation (Fig. 1*C*) essentially as figured for the genotype, except that the second branch of the fourth longitudinal vein is entirely lacking, so that the second and third posterior cells are fused; the first, second, and upper branch of the fork of the third, longitudinal veins end separately in the costa at a considerable distance from one another; the two branches of the fork of the third are widely separated at their base (on the second upper basal cell); the fourth vein forms one straight line with its upper branch; the fourth posterior cell is sessile at the base. Venation alike in both wings.

Integument with exceedingly fine and much scattered punctures, visible only under a high magnification; no striation, not even on the pleura.

Body very densely coverd with long hairs, which are grayish yellow, mixed with black on the thorax, mostly black and more uneven on the abdomen. Legs with long, yellowish pile, mixed with shorter, more russet hairs.

Entirely metallic green, even on the under side of the abdomen; appearing darker dorsally, on the abdomen, owing to the black pilosity. Legs black. Proboscis black. Wings subhyaline, hardly smoky.

Length, 9 mm.; of wing, 8.5 mm.; of proboscis, 14 mm.

ECUADOR.—Ambato, 1° 10′ S., 78° 42′ W., one male, holotype (Amer. Mus. Nat. Hist.).

Although the type is incomplete, I venture to describe it because no species of *Lasia* has as yet been reported from Ecuador. Additional specimens will have to decide whether or not the absence of the second branch of the fourth vein is a reliable specific character.

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FIRST SUPPLEMENT TO THE 'DIPTERA OF PORTO RICO AND THE VIRGIN ISLANDS'[1]

BY C. H. CURRAN

During the past year, two collections of Diptera from Porto Rico have been received by the author and, since several forms not previously examined are contained in the material, it seems advisable to publish a supplementary list at this time. In some cases I have omitted records of species in the collections now before me, since they are common and have previously been reported from various localities in Porto Rico.

The collections received have been made by Dr. W. T. M. Forbes of Cornell University, during a short collecting trip to Porto Rico and Dr. M. D. Leonard of the Insular Experiment Station, and Dr. W. A. Hoffman, of the University of Porto Rico. To them I wish to express my thanks for the privilege of examining the material and also for their generosity in donating to The American Museum of Natural History all type specimens and uniques. Wherever the material permits, paratypes of the species described are deposited in the Cornell University Collection.

List of species not previously recorded from Porto Rico or the Virgin Islands:

Tabanus nervosus, n. sp.
Tabanus parvulus Williston
Erax fœorbesi, n. sp.
Sigalœssa insularis, n. sp.
Plagiotoma pura, n. sp.
Setellia amabilis Williston
Euxesta mitis, n. sp.
Pseudogriphoneura vittifacies, n. sp.
Minettia picticornis Coquillett
Sobarocephala bivittata Melander and Argo.
Epigrimyia townsendi, n. sp.

List of species previously recorded from the Islands but either not mentioned in the 'Diptera of Porto Rico' or recorded under a different name:

Tabanus tinctus Walker
Tabanus stigma Fabricius
Tabanus hookeri Townsend
Diplocampta rœderi, n. sp.
Erax portoricensis Hine
Erax stylatus Fabricius
Oscinella forbesi, n. sp.

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[1] 'Scientific Survey of Porto Rico and the Virgin Islands,' XI, part 1.

STRATIOMYIDÆ

Six genera are recorded from the Islands and to these another must be added. The species upon which it is based is not new although it has remained unknown for a century.

NEUROTA, new genus

Related to *Aochletus* Osten Sacken but the scutellum is unarmed.

Face convex, receding, scarcely projecting beyond the eyes; eyes of male contiguous above, short pilose; third antennal segment elongate oval, tapering apically, the two-jointed style not distinctly differentiated and bearing short, appressed hair, the annules of the segment not haired. Scutellum unarmed. Four posterior veins, all arising from the discal cell and all reaching almost to the wing-margin. Abdomen short, broad, subrectangular from dorsal view, composed of five or six segments. Legs simple, short.

GENOTYPE.—*Sargus bicolor* Wiedemann.

Neurota bicolor Wiedemann

Sargus bicolor WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 41.

Four males and one female, Puerto Real, Vieques Island, April 29, 1930 (W. T. M. Forbes).

Head black, the male with the frontal triangle whitish, the female with a broad, narrowly interrupted white band above the antennæ; face, and front of the female, with silvery tomentum; antennæ reddish, the style black. Thorax black, golden or pale yellow tomentose; a narrow white stripe along the upper margin of the pleura in front of the wings; posterior calli reddish. Wiedemann states that the color is golden green but this applies only when the insect is examined without magnification. Legs and abdomen reddish yellow, the fifth abdominal segment sometimes mostly black or brown. Wings hyaline, with brownish yellow veins and luteous stigma. The length varies from 4 to 5.5 mm.

Hermetia albitarsis Fabricius

FABRICIUS, 1805, 'Syst. Antl.,' p. 63.

One female, Las Cruces, Cidra, April 4, 1930 (W. T. M. Forbes).

The absence of the translucent yellowish or whitish spots on the second abdominal segment will at once distinguish this species from *illucens* Linnæus.

TABANIDÆ

At the time of the preparation of the report on the 'Diptera of Porto Rico and the Virgin Islands,' no representatives of this family could be located in the collection, although two species were listed. Since that time five species have come to hand and I am enabled to present a review of the species occurring in the Islands. Since the species of *Chrysops* occurring in Porto Rico is rather aberrant, I include the genus *Diachlorus* Osten Sacken in the key.

KEY TO GENERA

1. Posterior tibiæ without spurs at the tip . . . . .2.
   Posterior tibiæ with spurs at the tip . . . . *Chrysops* Meigen.
2. Third antennal segment cylindrical, basal part not flattened or angulate . . .3.
   Third antennal segment laterally compressed and more or less angulate above near the base. . . . . *Tabanus* Linnæus.
3. Front of female narrow; face rather evenly convex . *Diachlorus* Osten Sacken.
   Front of female wide; face with three convex swellings . . *Chrysops* Meigen.

Chrysops variegatus DeGeer

Tabanus variegatus DeGeer, 1776, 'Mem. Hist. Ins.,' VI, p. 230 (Fig.).
Tabanus costatus Fabricius, 1794, 'Ent. Syst.,' IV, p. 373.

Four females, Coamo Springs, January 7, 1915 (Crampton); Mayaguez, July 24–29, 1914 (Watson) and June 21–23, 1915 (Lutz and Mutchler).

In this species the spurs on the posterior tibiæ are so small as to be almost wanting, and I am not sure that they are always present.

TABANUS Linnæus

Five species of *Tabanus* are known to occur in the Islands, two of them originally described from St. Thomas. One of these I have before me, but the second has not been recognized since it was originally described.

Table of Species

1. Smaller species, not over 15 mm. in length. . . . . .2.
   Large species, measuring more than 20 mm. in length. . . . . . *tinctus* Walker.
2. All the cross-veins spotted or clouded with brown. . . . . .3.
   Wings practically unicolorous; subcallus shining. . . . .*hookeri* Townsend.
3. Veins reaching the hind margin of the wing strikingly bordered with black. *nervosus*, n. sp.
   Veins reaching the hind margin not strikingly darkened. . . . . .4.
4. Costa broadly brown apically. . . . . *parvulus* Williston.
   Costa not broadly brown apically. . . . . .5.

5. Frontal callus as long as wide, practically square, front with median and upper brownish band . . . . *stigma* Fabricius.
Frontal callus almost or quite twice as wide as high; front uniformly cinereous-white pollinose and very wide (Florida). . . . *psammophilus* Osten Sacken.

Tabanus tinctus Walker

WALKER, 1850, 'Ins. Saunders., Dipt.,' p. 29.

I have not seen this species which was originally described from "St. Thomas?" The length is given as 11½ lines and, since none of the other species known to occur in the islands nearly approaches this in size, it should be readily recognized.

Tabanus stigma Fabricius

FABRICIUS, 1805, 'Syst. Antl.,' p. 104.
Tabanus completus WALKER, 1848, 'List. Dipt. Brit. Mus.,' p. 185.

Male, Villa Margarita, Cataño, April 21, 1930 (W. T. M. Forbes); two males, Dorado, May 23, 1930, and female, Guayama, July 26, 1930 (W. A. Hoffman).

I have no doubt about the above synonymy being correct as, in both cases, the type material came from St. Thomas and the specimens before me fit the descriptions quite well.

This is the species which has been recorded from Porto Rico as *psammophilus* Osten Sacken and it seems very strange that the two should have been confused. *T. stigma* is decidedly smaller than *psammophilus* and the abdomen bears distinct, interrupted brownish fasciæ on at least several of the segments. It also lacks the black median vitta and this character may be used to distinguish *psammophilus* when the abdomen has become discolored. Normally, the abdomen of *psammophilus* is uniformly cinereous-white pollinose, but in older specimens the whitish sheen tends to disappear, the median dark vitta then becoming obvious. My smallest specimen of *psammophilus* measures almost 13 mm. in length, the largest of *stigma* about 11.5 mm. The females are, of course, readily distinguished by the frontal characters.

Tabanus nervosus, new species

Figure 1

Larger than *stigma* Fabricius and with the basal half of the third antennal segment and the annulate part deep black, the antennæ otherwise reddish. It differs from *psammophilus* Osten Sacken by the very much smaller frontal callus and the black tips to the veins. Length, 11.5 to 12.5 mm.

FEMALE.—Head densely cinereous white pollinose; pile white, the front with short, sparse, black hairs. Front of moderate width, slightly narrowing below;

callus sub-oval, well separated from the orbits, transverse; ocelli wholly absent; front unicolorous. Palpi whitish, short, broad and rounded apically, white-haired. Antennæ yellowish red, the basal two-fifths of the third segment and the annulate portion, deep black; third segment not at all produced, decidedly less than twice as long as wide.

Thorax brownish yellow in ground color, the pleura with large dark spots, the mesonotum with five black or brown vittæ. The median black vitta is very broad and is only narrowly separated from the adjoining ones, the outer vittæ are represented by a stripe on either side above the roots of the wings. The black stripes do not reach the scutellum and they are so wide as to make the disc of the thorax appear black, although it is probable that the grayish pollen would almost conceal the ground color in fresh specimens. The whitish hair of the thorax is very fine, that on the mesonotum and scutellum appressed.

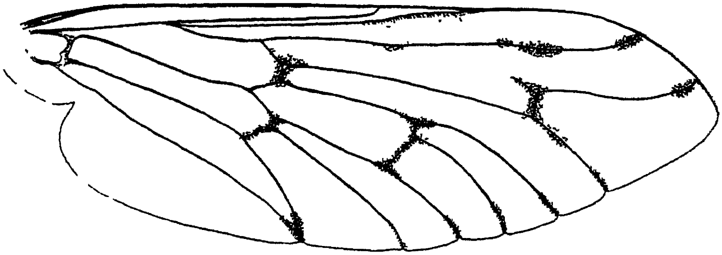

Fig. 1. Wing of *Tabanus nervosvs*, new species.

Legs reddish, the tibiæ and basal tarsal segment yellow and clothed with white pollen; apices of all the femora and tibiæ and the apical tarsal segments black; trochanters brown; apex of first segment of the tarsi and much of the two following segments black. Hair yellowish white, the black parts of the tibiæ and tarsi with black hair.

Wings with a distinct whitish tinge, all the cross-veins and the tips of the veins bordered with black. Squamæ white. Halteres reddish with somewhat darker knob.

Abdomen dull reddish brown, the first segment and sides of the following two reddish; apices of second and following segments cinereous. The abdomen is apparently rather discolored so that I am unable to determine the color of the pollen or the extent of the pale markings. The ground color shows median paler spots on the second and third segments and subdorsal spots on the sides of the second to fourth segments. The presence of these spots leads me to believe that fresh specimens will show three rows of small whitish spots on at least the second to fourth segments. Hair yellowish white, appressed, the apical three segments with coarse, black, subappressed hair.

TYPES.—Holotype, female, Villa Margarita, Cataño, April 21, 1930 (Forbes); paratype, female, San Juan, August 19, 1914.

The paratype is much paler in color than the type but is not in as good condition.

Tabanus parvulus Williston

Williston, 1887, Trans. Kans. Acad. Sci., X, (1885–1886), p. 141.

One female, Jajome Alto, June 16, 1930 (Hoffman).

Tabanus parvulus was described from a single female from San Domingo and I do not know of any subsequent records. The type is defective in that it lacks the palpi which are long and slender and clothed, at least in part, with short black hair. Unfortunately, the specimen before me has been wet, so that I am unable to judge accurately the color of the pollen. However, it agrees in all characters with Williston's description and, since the wing markings, etc. are quite distinctive, there can be no doubt of its identity.

There is a very closely related species occurring in Cuba but this latter has the third antennal segment longer, more slender and without any angulation. The coloration of the wings is also somewhat different and the thorax is darker in ground color.

Tabanus hookeri Townsend

Townsend, 1915, 'Ins. Ins. Mens.,' III, p. 48.

Four males and one female, Puerto Real, Vieques Island, April 28 and 29, 1930 (Forbes, Leonard).

This is a small grayish-yellow species, the abdomen mostly reddish with three more or less distinct rows of pale spots. It is easily recognized by its small size (10 to 11.5 mm.) and the bare, shining reddish subcallus. There are no ocelli and the eyes are haired in both sexes.

In addition to the specimens enumerated above there is a single female from Cuba.

BOMBYLIIDÆ

The following key includes all the genera so far recorded from the Islands.

Key to Genera

1. The furcation of the second and third veins occurs opposite or almost opposite the anterior cross-vein at almost a right angle. . . . . .2.
The furcation takes place well before the cross-vein at a sharp angle. . . . . . 6.
2. Antennal style not terminating in a pencil of hairs. . . . . 3.
Antennal style terminating in a pencil of hairs, distinctly separated from the third segment. . . . . *Anthrax* Scopoli.
3. Style distinctly separated from the third antennal segment. . . . . 4.
Style not separated from the third segment. . . . . .5.
4. Four submarginal cells. . . . . *Hyperalonia* Rondani.
Three submarginal cells. . . . . *Exoprosopa* Macquart.

5. Second vein curved almost S-shaped before the apex. . . *Diplocampta* Schiner.
   Second vein with a single curve. . . *Villa* Lioy.
6. Wings with four posterior cells. . . . . 7.
   Wings with three posterior cells. . *Geron* Meigen.
7. First posterior cell closed. . . . *Heterostylum* Macquart.
   First posterior cell open. . *Phthiria* Meigen.

Hyperalonia cerberus Fabricius

Anthrax cerberus Fabricius, 1794, 'Ent. Syst.,' IV, p. 256.

Male, Salinas, Vieques Island, April 29, 1930 (M. D. Leonard); female, Dorado, March 28, 1930 (W. A. Hoffman).

Villa gorgon Fabricius

Anthrax gorgon Fabricius, 1805, 'Syst. Antl.,' p. 126.

Three specimens from Salinas, Vieques Island, April 29, 1930 (Leonard) and two from Guayanilla, April 6, 1930 (Forbes).

Villa lucifer Fabricius

Bibio lucifer Fabricius, 1775, 'Syst. Ent.,' p. 759.

Four specimens, Coamo Springs, April 8, 9, 1930 (Forbes).

Villa lateralis Say

Anthrax lateralis Say, 1823, Journ. Acad. Nat. Sci. Phila., III, p. 42.

One specimen, Salinas, Vieques Island, April 29, 1930 (Leonard).

Diplocampta Schiner

This genus, established for a species occurring in Chile, has two representatives in North America. These two species differ from the genotype in having the third antennal segment conical instead of round basally and with a pronounced style. In wing venation the species agree well except that there are seldom more than three submarginal cells, very rarely four as in the genotype. The three species are separable as follows:

Table of Species

1. All the cross-veins broadly clouded with black or brown. . . . . 2.
   Cross-veins not clouded (Chile). . . . . *singularis* Schiner.
2. Petiole of the third posterior cell much longer than the cross-vein; second abdominal segment with a very broad white band. . . . . *rœderi*, n. sp.
   Petiole shorter than the cross-vein; abdomen without white fascia (Mexico, Panama). *paradoxa* Jænnicke.

Diplocampta rœderi, new species

Figure 2

Villa paradoxa Curran, 1928, 'Sci Surv P R and Virgin Islands, XI, part 1, p 20

This species is very similar to *paradoxa* Jænnicke and was identified as that species by von Rœder It is, however, a much darker species and is readily distinguished by the characters given in the key Had I not secured a typical specimen of *paradoxa* in the Canal Zone, I should still consider the Antillean form to be that species, but the two are so distinct that a name must be given to the West Indian form, of which Dr Leonard has secured fresh specimens Length, 7 5 to 8 mm

Male —Head black in ground color, brown pollinose, the scale-like tomentum brownish-golden, hair black Occipital pile white Face acute Proboscis as long as the head Antennæ black, the first segment reddish, third segment conical, narrow on apical half

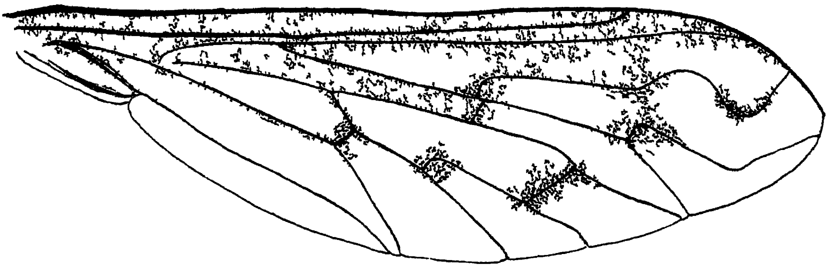

Fig 2 Wing of *Diplocampta rœderi*, new species

Thorax black, the anterior and lateral margins white pilose, the mesonotum with golden tomentum mixed with more or less black, the posterior border and base of the scutellum white tomentose Scutellum with golden and black tomentum and bearing four pairs of marginal bristles Lower half of the pleura yellowish-haired although there are black hairs intermixed

Legs brown, with black and yellowish tomentum, anterior tibiæ without spicules

Wings hyaline, with a dark brown pattern as shown in figure 2

Abdomen black, second fifth, sixth, and seventh segments white tomentose on the basal two-thirds the apices of the segments with tawny tomentum, the third and fourth segments with black tomentum predominating on the disc and with a transverse white spot on either side, hair on the sides of the abdomen toward the base white the bristly hair black

Female —Differs sexually

Types —Holotype, male, and paratype, male, Salinas, Vieques Island, April 29, 1930 (Leonard) Allotype, female, and two males and one female, Ensenada, June 14–19, 1915, one male, St Thomas Island, March 13, 1925 (Lutz)

In *paradoxa* Jænnicke the hair and tomentum on the thorax and abdomen are yellowish and there are but few black tomentose hairs

ASILIDÆ

Four specimens belonging to this family were collected by Dr. Forbes. These represent an undescribed species of *Erax*.

ERAX Scopoli

The species of *Erax* reported from Porto Rico are tabulated in the accompanying key. *Erax bastardi* Macquart, reported from the Island, is omitted, since the record is almost certainly based upon a misidentification.

TABLE OF SPECIES

1. Costa of male not dilated . . . . *portoricensis* Hine.
   Costa of male dilated. . . . . .2.
2. Males. . . . . .3.
   Females . . . . .5.
3. Lower forceps of the genitalia black-haired. . . . . .4.
   Lower forceps of the genitalia white-haired. . . . . *forbesi*, n. sp.
4. Apical three abdominal segments wholly silvery. . . . . *tortola* Curran.
   Apical two and one-half abdominal segments silvery. . . . *stylatus* Fabricius.
5. Anterior edge of the mesonotum narrowly white-haired . . . . . .*tortola* Curran.
   Anterior edge of the mesonotum with white hair only laterally. . . . . . . .6.
6. Apical segment of the palpi white-haired on the basal two-thirds .*forbesi*, n. sp.
   Apical segment of the palpi black-haired on almost the whole length dorsally and on the whole apical half. . . . . *stylatus* Fabricius.

Erax portoricensis Hine

HINE, 1919, Ann. Ent. Soc. America, XII, p. 128.

I have not seen this species which was described from a single male from Ensenada. The type is supposed to be in the American Museum but evidently has not been returned by Dr. Hine.

Erax stylatus Fabricius

Asilus stylatus FABRICIUS, 1775, 'Syst. Ent.,' p. 795.
Erax rufitibia MACQUART, 1847, 'Dipt. Exot.,' Suppl. III, p. 187 (27).
Erax haitensis CURRAN, 1928, 'Dipt. Porto Rico and Virgin Islands,' p. 24.

In 1928 I recognized this species from St. Thomas and Tortola Islands under the name *haitensis*. It is most likely that Fabricius' type came from St. Thomas, in which case there can be no doubt about the synonymy. It is probable the *E. rufitibia* Macquart is this species although we must not overlook the fact that it may be the same as *haitensis* Macquart, described on the following page.

The species described by Hine as *E. stylatus* is not that species but is evidently the same as *haitensis* Macquart, a species having white-haired palpi. The description given by Fabricius will not apply to this form, since the black markings on the abdomen are very much reduced.

E. fortis Walker may also prove to be a synonym of *stylatus*.

The above disposition of *E. rufitibia* Macquart leaves *rufitibia* Hine without a name, but inasmuch as a thorough study of the insular species should be undertaken, I leave the species unnamed.

Erax forbesi, new species

Figure 3

Related to *stylatus* Fabricius and *tortola* Curran but at once distinguished by the white-haired lower forceps in the male and by the more extensively white-haired palpi in the female. Length, including genitalia, 17 to 19 mm., exclusive of genitalia, 15 mm.

MALE.—Head black, grayish pollinose with brownish tinge; hair white, bristles on upper half of the mystax and on the ocellar triangle, black, those on the lower half of the mystax yellow; the strong facial swelling occupies the lower two-thirds of the face. Antennæ black, white-haired; third segment elongate oval, style longer than either antenna, gently swollen just before the acute tip. Palpi black, white-haired, with one or two black bristles at the apex.

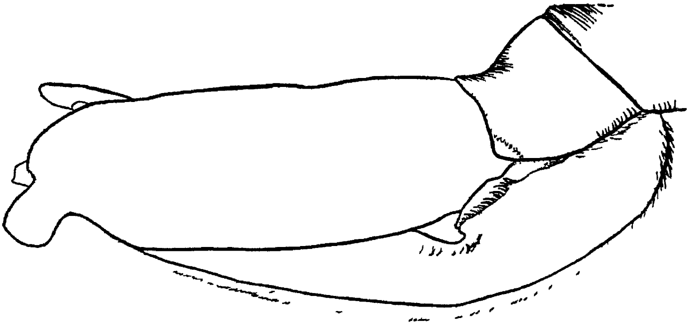

Fig. 3. Lateral view of male genitalia of *Erax forbesi*, new species.

Thorax cinereous pollinose, the mesopleura and the anterior two-thirds of the mesonotum with strong brownish-yellow tinge; black markings conspicuous. Hair white, black on the mesonotum except posteriorly, the humeri white-haired in front. Scutellum white-haired and with three or four marginal pairs of pale yellowish bristles.

Legs black; tibiæ reddish with broad black apices; femora sometimes mostly brownish red. Hair white on the femora and under surface of the tibiæ; elsewhere black; bristles black, the hairlike bristles on the tibiæ white.

Wings hyaline, the apical fourth tinged with brown. Anterior branch of third vein with an appendage; costa moderately dilated.

Abdomen black, the sixth and seventh segments silvery, the sides of the basal segments, expanding posteriorly, broadly cinereous pollinose. The abdomen has been discolored so that it is not possible to determine the color of the dorsal pollen. Hair white, not conspicuous dorsally. Genitalia shining black, black-haired, the lower lamellæ white-haired.

FEMALE.—Third antennal segment slightly shorter; palpi black-haired on the apical third; mesonotal pollen more yellowish brown; pollen on the dorsum of the abdomen brownish, paler posteriorly on each segment. Ovipositor long (4.5 mm.), shining black.

TYPES.—Holotype, male, allotype, female, and two female paratypes, Coamo Springs, April 5, 1930 (Forbes).

DOLICHOPIDÆ

Sciapus unicinctus Van Duzee

Psilopus unicinctus VAN DUZEE, 1927, Amer. Mus. Novit., No. 262, p. 6.

Three males and two females, Dorado, March 28, 1930 (W. A. Hoffman).

CHLOROPIDÆ

HIPPELATES Loew

The three species in the present collection have all been previously recorded.

Hippelates peruanus Becker

BECKER, 1912, Ann. Mus. Nat. Hung., X, p. 170.

Two females, Puerto Real, Vieques Island, April 29, 1930 (W. T. M. Forbes).

Hippelates partitus Becker

BECKER, 1912, Ann. Mus. Nat. Hung., X, p. 89.

One male, Puerto Real, Vieques Island, April 29, 1930 (Forbes).

Hippelates flavipes Loew

LOEW, 1865, 'Cent.,' VI, No. 95.

Three specimens from Puerto Real, Vieques Island, April 28 and 29, 1930 (Forbes).

OSCINELLA Becker

In my report on the 'Diptera of Porto Rico' I used the name *Botanobia* Lioy for this genus. A study of Lioy's paper indicates that the genotype probably belongs to a different genus, but the description is so inadequate that the species is entirely unrecognizable. Under the circumstances, the logical thing to do is to make use of the only name available, *Oscinella* Becker, proposed to replace *Oscinis* Latreille, preoccupied.

Dr. Forbes secured a series of the form which I had doubtfully recorded as *Botanobia coxendix* Fitch (p. 58), and this fresh material confirms my expressed belief that *coxendix* does not occur on the Islands. The species is undescribed and is abundantly distinct from *coxendix*.

Oscinella forbesi, new species

Black, the head and legs largely yellowish; mesonotum wholly pollinose; ocellar triangle pollinose. Length, 1.1 to 1.5 mm.

MALE AND FEMALE.—Face, cheeks and anterior half of the front yellowish. Upper part of the front black, cinereous pollinose; frontal triangle shining black, reaching the anterior third of the front, its sides practically straight, the immediate vertex and the ocellar triangle cinereous pollinose; hair short, fine, black; no distinct frontal bristles. Occiput cinereous pollinose. Cheeks brownish behind, very narrow, wider in the female. Palpi yellow, rather large. Antennæ reddish yellow; third segment suborbicular, broader than long, broadly brownish above; arista brownish, short pubescent.

Thorax black, thinly cinereous pollinose, the mesonotum mostly brown pollinose, the lateral and anterior borders cinereous. On the anterior half there are three rows of hairs between the dorsocentral rows; on the posterior half the hairs are not arranged in rows. Hair and bristles black or brown. Pleura mostly shining black, pollinose above. Scutellum with one pair of strong bristles, a weak pair and scattered hairs.

Posterior four coxæ and all the femora brown or black, the anterior coxæ and all the tibiæ and tarsi yellowish, the tibiæ usually tinged with brown medianly. Hair yellow or brownish yellow.

Wings cinereous hyaline; third costal section a little more than half as long as the second; fourth vein ending practically in the tip of the wing. Halteres white.

Abdomen shining brownish, the first segment more or less reddish. Hair black.

TYPES.—Holotype, male, allotype, female, Puerto Real, Vieques Island, April 28, 1930; paratypes, 12 females, Puerto Real, April 28 and 29 (W. T. M. Forbes); eight females, Adjuntas, June 8–13, 1915; Aibonito, July 14–17, 1914; Arecibo, June 24–25, 1915; Corozal, July 2, 1915; Manati, June 27–29, 1915; Naguabo, March 7–9, 1914; Charlotte Amilia, St. Thomas Island, June 3, 1911. Paratypes in Cornell University Collection.

ASTEIIDÆ

This family was not included in the key. It traces to Chloropidæ couplet 33, and may be distinguished by the entire costa. In the Chloropidæ the costa is fractured before the end of the first vein. There are, three genera of Asteiidæ known from America.

KEY TO GENERA

1. Posterior cross-vein present.... ....2.
   Posterior cross-vein absent ....*Asteia* Meigen.
2. Front with two bristles near the middle, half-way between the ocellar triangle and antennæ......... ....*Crepidohamma* Enderlein.
   Front with only weak orbitals....... . .. .*Sigalœssa* Coquillett.

SIGALŒSSA Coquillett

The three North American species are separable as follows:

TABLE OF SPECIES

1. Mesonotum pale ferruginous or reddish yellow. . . . . .2.
   Mesonotum shining black; front wholly shining black. . . *bicolor* Loew.
2. Lower part of pleura with two blackish spots; mesonotum reddish yellow. *flaveola* Coquillett.
   Lower part of pleura immaculate; mesonotum shining pale ferruginous. *insularis*, n. sp.

Sigalœssa insularis, new species

Brownish red or pale ferruginous and yellow. Length, 1.5 mm.

FEMALE.—Face and anterior half of the front dull yellow; cheeks and oral margin reddish brown, the former white pollinose. Front with two weak orbital bristles on the upper third, the anterior pair reclinate, the posterior pair weaker and proclinate; ocellars and postocellars very weak; verticals strong. Proboscis and palpi reddish yellow. Antennæ reddish yellow; arista pale brown, rather short-haired.

Thorax pale ferruginous; humeri and pleura reddish yellow, the scutellum pale yellow. A row of very inconspicuous acrostical hairs; two pairs of dorsocentrals. Scutellum with a pair of marginal bristles and one or two marginal hairs. Pleura with a median longitudinal, blackish stripe.

Legs reddish yellow. Wings hyaline; the tip of the second vein joins the tip of the first, the posterior cross-vein situated beyond the tip of the second vein; third and fourth veins approaching each other apically; no distinct alula.

Abdomen pale luteous dorsally, the tips of the segments darkened; sides brownish; under surface brownish, the membrane yellow.

TYPE.—Female, Puerto Real, Vieques Island, April 29, 1930 (W. T. M. Forbes).

OCHTHIPHILIDÆ

The original report recorded only one species from the Islands. Dr. Forbes secured a single specimen of *Leucopis bella* Loew, a species listed on page 116. The two genera known from the Islands are separable as follows:

A. Frontal orbits with bristles. . . . . *Acrometopia* Schiner.
B. Frontal orbits without bristles. . . . . *Leucopis* Meigen.

Leucopis bella Loew

LOEW, 1865, 'Cent.,' VI, p. 99.

One specimen, Puerto Real, Vieques Island, April 28, 1930 (W. T. M. Forbes).

The genus *Leucopis* contains a small number of species, all of which are beneficial. The larvæ are predaceous, feeding on aphids and mealy bugs and may be readily recognized by their peculiar shape. The posterior end is more or less truncate and the elongated spiracles project from either side, so that the larva is roughly triangular in outline from dorsal view. All I have seen have been dirty yellowish or grayish yellow in color and they may very often be found among colonies of aphids, particularly those frequenting the stems of plants. When not feeding they usually rest at the juncture of the leaf petiole and the stem.

MILICHIIDÆ

Milichiella lacteipennis Loew

Lobioptera lacteipennis Loew, 1865, 'Cent.,' VI, p. 97.

Male and two females, Puerto Real, Vieques Island, April 29, 1930 (W. T. M. Forbes).

TRYPANEIDÆ

Since the publication of my report two new genera have been established in this family for species previously placed in *Euaresta* Loew. Both genera are represented in the Islands but up to the present no species of *Euaresta* are known. The following key separates the genera recorded from the region.

Key to Genera

1. Proboscis elongate and geniculate.......... *Ensina* Desvoidy.
Proboscis short, not geniculate..........2.
2. Female ovipositor as long as the body and curved; wings brownish in front, hyaline behind.......... *Toxotrypanea* Gerstæcker.
Female ovipositor short or not curved; wings with markings on the posterior half..........3.
3. Scutellum with four bristles..........6.
Scutellum with two bristles..........4.
4. Apex of the wing wholly black; three pairs of cruciate orbitals.. *Aciura* Desvoidy.
Apex of wing with hyaline spots; two pairs of cruciate orbitals..........5.
5. Basal half of the wing hyaline.......... *Trypanea* Schrank.
Basal half of the wing with brown markings.......... *Dyseuaresta* Hendel.
6. One pair of dorsocentral bristles.......... *Anastrepha* Schiner.
Two pairs of dorsocentrals..........7.
7. Anal cell drawn out into a long, narrow triangle..........8.
Anal cell with or without a short triangular prolongation behind..........9.
8. Anterior cross-vein transverse.......... *Tetreuaresta* Hendel.
Anterior cross-vein oblique.......... *Plagiotoma* Loew.
9. Discal cell longest anteriorly.......... *Euaresta* Loew.
Discal cell very much longer posteriorly.......... *Polymorphomyia* Snow.

ACIURA Desvoidy

Aciura insecta Loew

LOEW, 1862, 'Mon. N. Amer. Dipt.,' I, p. 72 (f).

One specimen of this common and widely distributed species, Isabela Substation, April 24, 1930 (Forbes).

DYSEUARESTA Hendel

HENDEL, 1928, 'Ent. Mitt.,' XVII, p. 368.

Three species belonging to this genus are recorded from Porto Rico. Two of them have already been reported upon but I have not seen specimens of *mexicana* from the West Indies.

TABLE OF SPECIES

1. Marginal cell with two hyaline spots, the apical spot absent.............2.
Marginal cell with three hyaline spots.............*melanogaster* Loew.
2. Apex of the stigmal cell hyaline.............*plesia* Curran.
Stigmal cell wholly brown.............*mexicana* Wiedemann.

TETREUARESTA Hendel

HENDEL, 1928, 'Ent. Mitt.,' XVII, p. 368.

In this genus there are four scutellar bristles, three pairs of cruciate fronto-orbitals and the third wing vein is setose on almost its entire length. *Euaresta* Loew differs in having the third vein bristled only basally and but two pairs of orbitals.

T. obscuriventris Loew, occurring in the Islands, is the type of the genus.

POLYMORPHOMYIA Snow

Polymorphomyia basilica Snow

SNOW, 1894, Kans. Univ. Quart., II, p. 165 (f.).

Male, Naguabo, March 7–9, 1914. There is also a specimen from the Republic of Dominica, taken in June 1915.

PLAGIOTOMA Loew

TABLE OF SPECIES

1. Only two round prescutellar black spots on the mesonotum.............2.
Four black presutural spots.............*rudolphi* Lutz and Lima.
2. Second basal cell partly or wholly yellow.............3.
Second basal cell with scarcely any yellow and then only very narrowly along the veins.............5.
3. Second basal cell wholly yellow.............*biseriata* Loew.
Second basal cell partly hyaline.............4.

4. Abdomen with an interrupted median black vitta . . *trivittata* Lutz and Lima.
Abdomen without a median black vitta.... ....*jonasi* Lutz and Lima.
5. Abdomen wholly black..... ... . *discolor* Loew.
Abdomen yellow with lateral black spots... .. . .6.
6. Pleura without black spots except at the base of the halteres. *incompleta* Williston.
Pleura with black spots in addition to those about the halteres........... .. 7.
7. The apical hyaline fascia extends obliquely from the costa to the fourth vein. *pura*, n. sp.
The apical hyaline fascia extends obliquely from the apex of the wing to the second longitudinal vein . ...*obliqua* Say.

Plagiotoma pura, new species

Similar to *discolor* Loew except that the abdomen is shining rusty-reddish with black lateral spots. Length, 4 mm.

MALE.—Head reddish yellow, evidently with whitish pollen; occiput darker on the sides; antennæ and palpi reddish yellow.

Thorax rusty reddish-yellow, with opaque black spots as follows: one on either side of the mesonotum in front of the scutellum; one on the sternopleura, pteropleura, and in front of the root of the halteres. The spot in front of the halteres is triangular, the others circular.

Legs reddish yellow, with yellow hair. Wings hyaline and yellowish, with blackish markings along the border. The yellowish markings are arranged in the form of four arched fasciæ, the apical two united at the posterior end, the second and third at the anterior end, the basal one not connected with the others. The stigma, a spot about midway between the apices of the first and second viens, the apical border of the wing and the broad posterior ends of the first and second yellowish fasciæ, are blackish.

Abdomen rusty reddish, the third to fifth segments each with large shining black spot on either side. Hair black.

TYPE.—Male, Jajome Alto, June 18, 1930 (Hoffman).

This species agrees with *discolor* Loew in the wing pattern, in having the second and third colored fasciæ connected at the base (see Loew, 'Mon. N. A. Dipt.,' III, Plate x, fig. 1).

ORTALIDÆ

The present collections contain three species not previously examined by me. One of them has not been previously recorded from the Islands, while another is new to science. In the list of species on page 116, *Ortalis quadrivittatus* Macquart should be removed. The record is obviously based upon a misidentification, since Macquart's species came from Africa and belongs to the genus *Rivellia* Desvoidy. The addition of two genera to the list makes an amended key desirable.

KEY TO GENERA

1. First wing vein wholly bare . . . . 4.
First wing vein setose or hairy on apical third or more. . . . . . 2.
2. Scutellum with a large, polished black swelling on either side . . *Xanthacrona* Wulp.
Scutellum without such swellings . . . . 3.
3. Anal cell rounded apically . . . . . . *Macrostenomyia* Hendel.
Anal cell drawn out into a long point posteriorly . . . . . *Acrosticta* Loew.
4. Third antennal segment rounded apically . . . . 5.
Third antennal segment angled at its dorsal apex . . *Chætopsis* Loew.
5. Anal cell rounded apically . . . . *Setellia* Desvoidy.
Anal cell angulate at posterior apex or drawn out into a triangle . . . . . . 6.
6. Front with strong transverse wrinkles bearing obscure punctures. *Notogramma* Loew.
Front not strongly punctured or wrinkled . . . . *Euxesta* Loew.

Macrostenomyia guerini Bigot

Sepsis guerini BIGOT, 1857. in Sagra, 'Hist. Phys. Polit. Nat. Cuba,' p. 822.
Stenomacra guerini LOEW, 1873, 'Mon. N. A. Dipt.,' III, p. 180.
Macrostenomyia guerini HENDEL, 1907, Wien. Ent. Zeit., p. 98.

Male and female, Coamo Springs, April 4, 1930 (W. T. M. Forbes); male and female, Cidra, March 25, 1930 (M. D. Leonard).

Setellia amabilis Williston

Epiplatea amabilis WILLISTON, 1896, Trans. Ent. Soc. London, p. 376.

Five males and three females, El Yunque, Luquillo Mts., 1500 to 2000 ft., March 29, 1930 (W. T. M. Forbes).

There is no question about this being the species described by Williston, despite the fact that *Epiplatea* Loew has the first vein setose, a character overlooked by Williston. The species is retained in *Epiplatea* by Hendel in 'Genera Insectorum,' number 113.

Euxesta anonæ Fabricius

Musca anonæ FABRICIUS, 1794, 'Ent. Syst.,' IV, p. 358.

Four specimens from Porto Real, Vieques, April 28, 1930 (Forbes) and one April 29 (Leonard).

Euxesta mitis, new species

Figure 4

A very small species with three brownish-black spots on the wings and a very prominent clypeus. Length, 2.25 to 2.4 mm.

FEMALE.—Head black; anterior half of the front and the upper half of the face reddish; front strongly widening posteriorly; face projecting below, the clypeus very prominent, shining black; palpi brownish; frontal lunule whitish pollinose. Antennæ reddish, the apex of the third segment broadly brown; third segment short oval; arista brown.

Thorax bluish black, shining; two dorsocentrals, the anterior pair weak; hair not abundant; scutellum convex, with four bristles

Legs black; knees and tarsi luteous, the tarsi with the apical two segments brownish; coxæ and trochanters yellowish brown; hair black.

Wings hyaline, a narrow sub-basal band extending more than half-way to the posterior border of the wing, a large, subquadrate median spot and a triangular apical spot lying in front of the third vein, blackish brown. Halteres white.

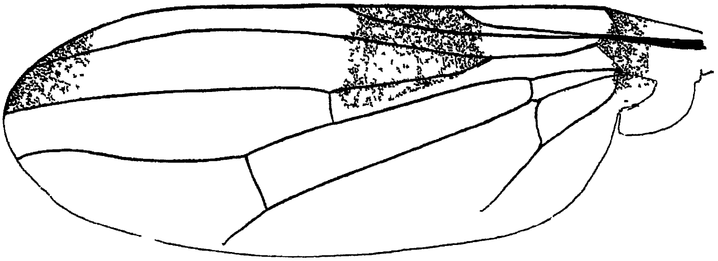

Fig. 4. Wing of *Euxesta mitis*, new species.

Abdomen shining black or bluish black, with sparse, short black hair. Ovipositor longer than wide, gently tapering.

Types.—Holotype, female, and one female paratype, Puerto Real, Vieques Island, April 29, 1930 (Forbes). The paratype is in Cornell University collection.

This species is rather aberrant for the genus but nevertheless I feel that it belongs here. The oral margin is more projecting than usual and the clypeus is much more developed than in any of the other species I have seen. In the key to the species on page 77 of the 'Diptera of Porto Rico,' etc., *mitis* will trace to *costalis* Fabricius but the wide front, wing markings, etc., at once separate it.

SAPROMYZIDÆ

An examination of specimens of *Pseudogriphoneura cineracea* Coquillett, from Florida proves that the specimen I recorded from Porto Rico belongs to a different species. Of the three species contained in the list on page 116 of the 'Diptera of Porto Rico,' *Sapromyza cincta* Loew belongs to the genus *Camptoprosopella* Hendel and the record is probably based on *C. diversa* Curran. *C. cincta* has generally been considered a synonym of *vulgaris* Fitch but I suspect that it is a distinct species; *S. octopunctata* Wiedemann I discuss below under *Pseudogriphoneura anomala* Curran; *Physegenua ferruginea* Schiner I have not seen from the Islands.

PSEUDOGRIPHONEURA Hendel

As indicated above there is some confusion in regard to the identification of the species belonging to this genus. I am therefore presenting an amended key to the species and discussing the relationships of the species concerned.

TABLE OF SPECIES

1. Mesonotum black, with two broad whitish vittæ which continue around the border of the scutellum. . . . . *albovittata* Loew.
   Mesonotum differently colored. 2.
2. Scutellum black or brown, pale pollinose. . . . . .3.
   Scutellum reddish with a black spot on either side apically. . . .*anomala* Curran.
3. Face, from dorsal view with two or four bare, longitudinal vittæ. *vittifacies*, n. sp.
   Face wholly pollinose (Florida). . . . . *cineracea* Coquillett.

Pseudogriphoneura albovittata Loew

Lauxania albovittata LOEW, 1852, 'Cent.,' II, No. 79.

Three specimens, Cidra, March 28, 1930 (M. D. Leonard).

Pseudogriphoneura anomala Curran

CURRAN, 1926, Amer. Mus. Novit., No. 220, p. 13.
?, *Sapromyza octopuncta* WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, p. 454.

After further study of the description of *octopuncta*, specimens of *Minettia slossonæ* Coquillett, and the types of *anomala*, I am inclined to the belief that *octopuncta* has been misidentified by authors and that the name applies to *anomala*. However, the fact that Wiedemann made no mention of the black spot on the pleura leaves the question in doubt. Certainly Wiedemann's description fits *anomala* in other respects, particularly in having the black spots on the sides of the second to fourth segments increasing in size on the apical segments. As indicated in my description of *anomala* there is only a single sternopleural bristle and an intra-alar bristle is present. This latter character does not agree with the diagnosis of *Pseudogriphoneura*, nor does the absence of the anterior sternopleural agree with *Minettia*. I have previously thought that *M. slossonæ* might be the same as *octopuncta* but the shape of the black abdominal markings precludes this. The type of *octopuncta* is in Copenhagen and I believe that an examination of it will prove the synonymy suggested to be correct, but until this has been determined it is better to use the name *anomala*.

Pseudogriphoneura vittifacies, new species

Pseudogriphoneura cineracea CURRAN, 1928, 'Scien. Surv., P. R. and Virgin Islands, XI, part 1, p. 83 (not Coquillett).

Related to *cineracea* Coquillett but at once distinguished by the presence of two or four shining vittæ on the face (the outer ones sometimes absent) and the reddish, more extensively brown-pollinose mesonotum and scutellum. Length, 4 mm.

Head brownish, the central part of the front, anterior border and the inner part of the parafacials, reddish; pollen whitish, the stripe along the frontal bristles more yellowish; face with four longitudinal bare vittæ; cheeks with a brown spot on the anterior half; occiput bare except broadly along the orbits. Cheeks broad; palpi black. Antennæ brownish red, the third segment broadly brown above and apically, about three times as long as wide; arista black, moderately long plumose.

Thorax black, the mesonotum, scutellum and mesopleura reddish-brown pollinose, or largely so, each bristle and hair arising from a darker spot; humeri, a contiguous spot inside them, the supra-alar declivity and the pleura gray pollinose, the pale pollen more extensive in the female. Two pairs of dorsocentrals and a pair of prescutellar acrosticals. Hair black.

Legs black; tarsi brown, the bases of the tibiæ and the basal segment of the posterior four tarsi yellowish.

Wings tinged with brown. Halteres yellow.

Abdomen shining black, in some lights very thinly brown pollinose.

TYPES.—Holotype, male, Aibonito, July 14–17, 1914; allotype, female, the same data; paratype, female, Adjuntas, June 8–13, 1915.

Among the characters separating this species from *cineracea* are the wider front, brownish instead of luteous wings, larger size, etc.

MINETTIA Desvoidy

One of the species before me is new to the Islands, hence I present a key including the five species known to occur.

1. Face unicolorous . . . . 3.
   Face with a black spot below . . . . 2.
2. Pleura with two black vittæ; mesonotum vittate . . *picticornis* Coquillett.
   Pleura with two black spots, the mesonotum not vittate. . . . *slossonæ* Coquillett.
3. Scutellum with a black spot on either side. . . . . 4.
   Scutellum wholly yellowish. . . . . *aibonito* Curran.
4. Black spots lying beneath the apical scutellar bristles. . . . . . *mona* Curran.
   Black spots situated between the first and second pairs of scutellars.
   sororia Williston.

Minettia picticornis Coquillett

Sapromyza picticornis COQUILLETT, 1904, Proc. Ent. Soc. Wash., VI, p. 189.

Two specimens, Dorado, March 28, 1930 (W. A. Hoffman).

The mesonotum bears four black vittæ and the abdomen a median row of roundish spots and lateral rows of transverse ones.

Minettia slossonæ Coquillett

Sapromyza slossonæ Coquillett, 1898, Can. Ent., XXX, p. 277.

A female from Cidra, March 28, 1930 (M. D. Leonard).

MICROPEZIDÆ

No key to the genera occurring in the Islands was given in the report and one is now presented. Since only one species of each genus is known to occur, identification should not be difficult.

KEY TO GENERA

1. Arista dorsal. . . . . .2.
   Arista apical . . . .*Nerius* Fabricius.
2. Head higher than long. . . . . 3.
   Head longer than high. . . . .*Micropeza* Meigen.
3. Arista bare. . . . . .4.
   Arista plumose. . . . .*Systellapha* Enderlein.
4. Apical petiole of the anal cell much longer than the width of the cell. *Hoplocheiloma* Cresson.
   Petiole of anal cell very short, not nearly as long as the width of the anal cell. *Tæniaptera* Macquart.

Nerius cinereus Roeder

Roeder, 1885, Stett. Ent. Zeit., p. 348.

I have not seen specimens of this species which was originally described from Porto Rico.

Micropeza limbata Roeder

Roeder, 1885, Stett. Ent. Zeit., p. 347.

Female, Cidra, March 28, 1930 and female, Mavicao, May 30, 1930 (M. D. Leonard).

Systellapha scurra Enderlein

Enderlein, 1922, Arch. Naturg., Abt. A, LXXXVIII, Heft, 5, p. 191.

Eight females, El Yunque, Luquillo Mts., March 29, 1930, 2000 to 3500 ft. (W. T. M. Forbes).

Tæniaptera lasciva Fabricius

Musca lasciva Fabricius, 1798, 'Syst. Ent.,' Suppl., p. 564.

Male and female, Rio Piedras, March 25, 1930 (W. T. M. Forbes).

CLUSIIDÆ

This family has not previously been recorded from Porto Rico, although known to occur in adjacent islands.

Sobarocephala bivittata Melander and Argo

Melander and Argo, 1924, Proc. U. S. Nat. Mus., LXIV, Art. 11, p. 37.

Male and female, Dorado, March 28, 1930 (W. A. Hoffman).

Both specimens have the scutellum wholly yellowish but are otherwise typical. The type series from Costa Rica contained specimens agreeing with those before me.

SARCOPHAGIDÆ

Sarcophaga culminata Aldrich

Aldrich, 1916, 'Sarcophaga and Allies,' p. 289.

One male, Cidra, March 26, 1930 (Leonard).

In the above cited reference Aldrich included this species in group H in which there are four postsutural dorsocentral bristles. Despite this I determined specimens having only three postsuturals as this species and an examination proves that the type has the fewer number and should have been included in group D.

Sarcophaga plinthopyga Wiedemann

Wiedemann, 1830, 'Ausser. Zweifl.,' II, p. 360.
Sarcophaga robusta Aldrich, 1916, 'Sarcophaga and Allies,' p. 268.

One male, Puerto Real, Vieques Island, April 29 (Forbes).

TACHINIDÆ

Of the four species of Tachinidæ in the present collection, each belonging to a different genus, two have not previously been recorded from the Island.

EPIGRIMYIA Townsend

This genus, not previously reported from Porto Rico, traces to *Stomatodexia* Brauer and Bergenstamm in the key. It differs in that the arista is not short plumose. Some of the species of *Epigrimyia* (including the genotype) have the apical cell closed in or near the wing margin but the character is hardly sufficiently important to serve as the basis for distinct genera.

Epigrimyia townsendi, new species

Related to *robertsoni* Townsend but with black legs, more broadly shining segmental apices and the third vein bristled as far as the anterior cross-vein. Length, 5.5 mm.

Female.—Head black, white pollinose, the front and upper posterior orbits with yellow tinge; face and cheeks reddish yellow in ground color, the facial ridges black. Apical section of proboscis equal to head-height; palpi reddish yellow;

antennæ reddish yellow, the third segment mostly black; arista black, distinctly pubescent; occiput pale pilose except above.

Thorax black, cinerous-white pollinose, the four dark vittæ distinct, the pollen between the outer and inner vittæ brownish. Acrosticals, 2–3; dorsocentrals, 3–3; posterior sublateral absent; sternopleurals, 2–1; three pairs of marginal scutellars and a pair of apical, non-cruciate bristly hairs; hair of thorax black.

Wings cinereous hyaline; apical cell open a little before the wing-tip; third vein bristled from its base to the small cross-vein. Squamæ white. Halteres pale yellow.

Legs black; anterior tibiæ with a single posterior bristle.

Abdomen black, the apical third of the third segment and the whole of the fourth reddish; second to fourth segments moderately cinereous pollinose on the basal two-thirds. Abdomen without discals; second segment with a pair of marginals, the third and fourth each with a row.

TYPE.—Female, Isabela Substation, April 24, 1930 (Forbes and Leonard).

Stomatodexia cothurnata Wiedemann

Stomoxys cothurnata WIEDEMANN, 1830, 'Ausser. Zweifl.,' II, 249.

Two females, Cidra, March 26, 1930 (Leonard) agree with the specimens previously recorded from the Islands. The record of *Leskia analis* from Porto Rico undoubtedly refers to this species.

Rhynchodexia sororia Williston

WILLISTON, 1896, Trans. Ent. Soc. London, p. 360.

One specimen, Rio Piedras, April 24, 1930 (Leonard).

I suspect that this name should be replaced by *rufianalis* van der Wulp but I have not examined sufficient material from Mexico to decide the question.

ORMIA Desvoidy

The species of this genus are all rusty yellowish in color, rarely with darker markings. The genus is readily recognized by the greatly swollen medianly sulcate prosternum. *Ormia punctata* Desvoidy has been recorded from Porto Rico but the record evidently refers to the following species.

Ormia dominicana Townsend

TOWNSEND, 1919, Proc. U. S. Nat. Mus., LVI, p. 548.

One female, Coamo Springs, April 10, 1930 (Forbes).

In the brief description no mention is made of the color of the epaulet of the wings. In the specimen before me this part is not black as is the case in most of the species, so it is possible that the specimen before me is not *dominicana*. Without an examination of the type it is not possible to decide the matter.

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A NEW RECONSTRUCTION OF *DINICHTHYS*

By Anatol Heintz[1]

In studying the *Dinichthys* material in The American Museum of Natural History, I have found some new features in the structure of *Dinichthys*, and, with these in mind, I have made a new reconstruction of this form. A larger paper on this subject is ready for publication in the 'Bashford Dean Memorial Volume.' Here I shall attempt only a short description of this new reconstruction.

Head Shield

In the head shield I discovered four new plates never before described in detail. These are:

1.—A small triangular plate, the postmarginal (PM of Fig. 1), placed behind the marginal and forming the extreme hind corner of the head roof. (This is known in *Phlyctænaspis* and *Heterosteus* as "Angulare").

2.—A small oblong plate, the postnasal, in front of the suborbital. This touches the preorbital and the rostral, and defines the nasal opening. A sensory canal on its surface connects the canals of the preorbital with those on the suborbital. (This plate is well known in *Coccosteus*.)

3.—A relatively large triangular plate behind the suborbital, the post-suborbital (PSO of Fig. 1). This fills the space between the suborbital and the extreme hind corner of the head. The "lower jaw" was attached to this plate by aid of

4.—a small triangular plate called the postero-infero-gnathal (Fig. 3*c*). (Mentioned by Adams in 1919.)

The head shield was strongly curved. The right and left antero-supero-gnathal were placed close together. The "lower jaw," in all probability, was connected in symphysis, by aid of cartilage or by an unknown bone plate.

Body Carapace

This reconstruction shows two new plates of the body carapace, well known from other Arthrodira. These are the intero-lateral and the spinal. They serve to connect the dorsal and ventral shields. In the older reconstructions these two plates were regarded as a part of the

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[1] Palæontological Museum, Oslo.

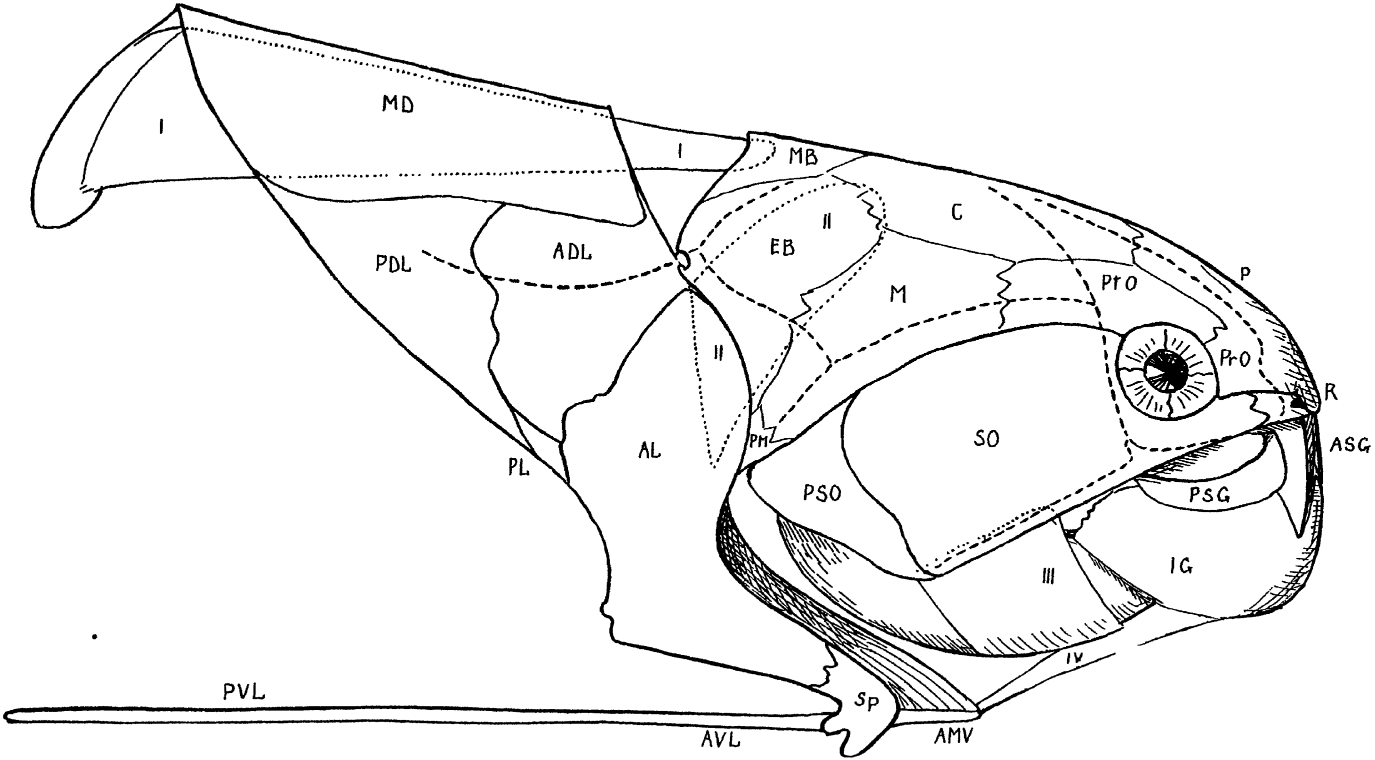

Fig. 1. Reconstuction of *Dinichthys* armor. Mouth closed.

I. Musculus levator capitis.
II. Musculus depressor capitis.
III. Musculus levator gnathalis.
IV. Musculus depressor gnathalis.

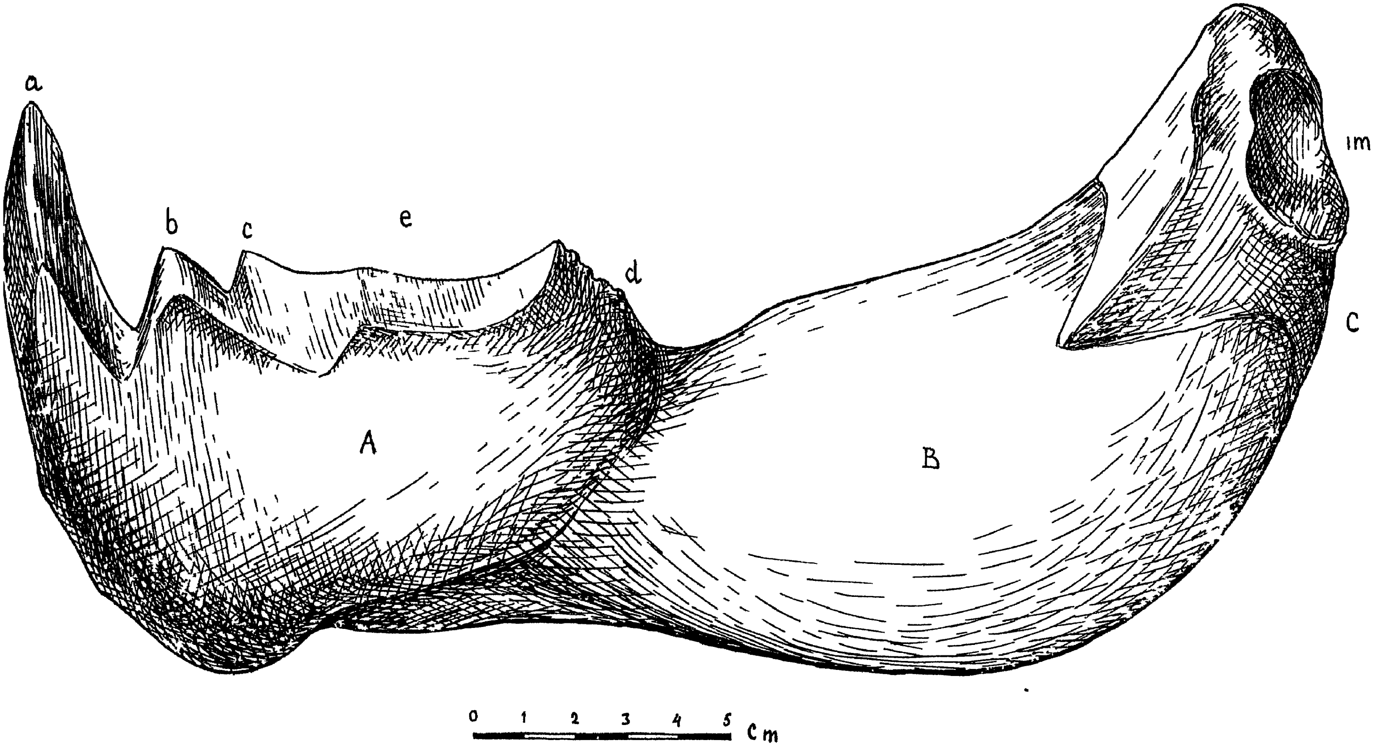

Fig 3 Infero-gnathal and postero-infero-gnathal (*D. intermedius* Newberry)

"clavicula" (Newberry), and the ventral and dorsal shields did not touch each other. The outlines of the postero-lateral plate were also not known before.

Movement of the "Jaws"

My investigations prove clearly that the theory regarding the jaw mechanism in Arthrodira, proposed in 1919 in America, by Adams, and in Germany by Jaekel, is correct. The joint between the lower and upper jaws was very weakly developed in the Arthrodira. On the other hand, the joint between the head and body carapace was very strong. In opening the mouth, *Dinichthys* raised the head (upper jaw) at this joint. The hind corner of the lower jaw, attached to the head roof, was thus elevated; the symphysial part moved down, and the mouth opened (Figs. 1 and 2).

This unusual mouth mechanism, never before observed in any other fossils or living animals, worked by means of four pairs of muscles. These were:

1.—Musculus levator capitis which ran from the median-basal (median-occipital) to the keel on the median-dorsal. These muscles lifted the head roof. (Figs. 1 and 2, I).

2.—Musculus depressor capitis, running from the impression on the under side of the head roof (between EB and M) obliquely downward to the keel on the under side of the antero-lateral. These muscles moved the head roof downward (Figs. 1 and 2, II).

3.—Musculus levator gnathalis which was attached to the lower margin of the infero-gnathal (lower jaw) on one side and to the ridge on the lower margin of the suborbital on the other. These muscles moved the lower jaw upward (Figs. 1 and 2, III).

4.—Musculus depressor gnathalis attached on one end to the under side of the front part of the infero-gnathal, and probably running downward to the antero-median-ventral on the ventral shield. These moved the lower jaw downward (Figs. 1 and 2, IV).

Thus, the I and IV pairs of muscles together operated to open the mouth; the II and III, to shut it.

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ROCKY MOUNTAIN BEES. II

By T. D. A. Cockerell

THE GENUS *ANDRENA*

The genus *Andrena*, named by Fabricius in 1775, is very rich in species in the northern hemisphere. Viereck, in 1912, designated *Apis helvola* Linnæus as the type. Bingham (1897) had earlier designated *Andrena cineraria*, but Fabricius did not include this in his *Andrena*, and it was first transferred thereto by Latreille in 1802. According to Morice and Durrant (1915), Lamarck, in 1801, cited *Apis succincta* Linnæus as the type of *Andrena*. Now Latreille, in 1802, cited *succincta* Linnæus as the type of *Colletes*. In the Linnean cabinet a specimen marked *Apis succincta* is a *Colletes*, as we now understand the genus, but according to Nylander it is not the species commonly called *C. succincta*, but *C. fodiens*. But Linnæus described *Apis succincta* as having "rostrum subulatum." Kirby, as early as 1800, noted that this did not well describe the *Colletes*, in spite of the ostensible type. Morice and Durrant further note that the bee was said to have four white bands (presumably no more) on the abdomen. This latter objection seems to have no basis, as the expression well describes a female *C. succincta* auct. in my collection. As regards the subulate rostrum, the maxillæ, often projecting in *Colletes*, would give this effect. So it seems probable that the preserved specimen is really the type, and that on this basis *Colletes* = *Andrena*. At this point a further complication arises, in the fact that Lamarck's *succincta*, placed in *Andrena*, is definitely said to have the tongue long, even greatly elongated. Thus, if the Linnean *succincta* is a *Colletes*, Lamarck's identification of it is wrong. Morice and Durrant further cite *A. cineraria* (Linnæus), *A. bicolor* (Fabricius), and *A. nitida* (Kirby) as alternative designations, by various authors, as the type of *Andrena*. Of these, only *A. bicolor* was among the original species; the reference is to Panzer, 1806, but it is not clear that it was a specific designation of type. Hence, probably Viereck's designation stands. *A. bicolor* Fabricius, according to Alfken (1929), is the species usually known as *A. gwynana* (Kirby), a member of the "group of *A. nigroænea*" of

Perkins. *A. helvola* belongs to the "group of *A. varians*" of Perkins. In either case we have true *Andrena* as generally understood, not *Trachandrena*. I do not think that the confused condition of affairs with regard to Lamarck's designation and the Linnean type should for a moment be allowed to upset the current application of the names *Andrena* and *Colletes*.

Colorado, at the present time, has about 150 recorded species of *Andrena* in the broad sense (including one *Iomelissa*, one *Diandrena*, and one *Parandrena*). This assemblage must not be cited as a single fauna, for the species occupy different life-zones and different parts of the very large area. A genuine faunal unit is that of the vicinity of Carlinville, Illinois, where Robertson by intensive collecting during many years obtained 52 species (one still awaiting description). Of these, 21 have also been found in Colorado. Graenicher, in Wisconsin, secured 18 species which were not found by Robertson in Illinois. For the whole northern states, east of Kansas and Nebraska, I find records of about 115 species, a few of them probably not distinct. Although the western species are generally distinct, at least when we get west of the Rockies, Dr. Lutz has taken Robertson's *A. helianthi* and *A. pulchella* (*accepta* Viereck) at Ogden, Utah; while *A. crataegi* Robertson reaches Vancouver Island, as also do *A. cressoni* Robertson and *A. viburnella* Graenicher. Other species extending into the Pacific Northwest are *A. hippotes* Robertson, *A. illinoensis* Robertson,[1] *A. vicina* Smith, and *A. carlini* Cockerell.

Professor O. A. Stevens, several years ago, sent me a list of the species of *Andrena*, determined by Viereck, which he had collected in North Dakota. There are 44 species, and the list is particularly interesting for the combination of eastern and western forms. Twenty-five are also found in Colorado; a considerably larger proportion than in the Illinois list. Twenty are common to Robertson's Illinois list. Some of the western species represented are: *A. lincolni* Viereck and Cockerell, *A. idahorum* Viereck, *A. nigrihirta* (Ashmead), *A. albihirta* (Ashmead), *A. hitei* Cockerell, *A. campanulæ* Viereck and Cockerell, *A. apacheorum* Cockerell, *A. pertarda* Cockerell, *A. colletina* Cockerell, *A. prunorum* Cockerell, and *A. helianthiformis* Viereck and Cockerell. One species, *A. sigmundi* Cockerell, comes over from the Wisconsin (not Illinois) fauna.

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[1] There is a curious controversy concerning *A. illinoensis*. Robertson long ago sent me specimens, and I accepted these as typical of the species, and so identified it in various papers. But, long after, Malloch visited Robertson and states that he had two species mixed, and that the specimen carrying the [illegible] that one had to be made. (See Entom. News, 1903, p. 215.)

New Mexico has 58 reported species of which 23 are common to Colorado. The New Mexico *A. prunorum* extends through Colorado to North Dakota, as just stated, while Lutz has taken it in Wyoming, Spalding in Utah, and Van Duzee in California. I believe that it was this species which was cited in Bull. Hayden Survey, 1877, p 785, from Manitou, Colorado, as *A. polygama* Davis. The now famous geographer, Professor W. M. Davis, told me how, when he was a young man, he started to work on *Andrena*, and had described a number of species in manuscript. Leconte thought he did not know enough, and the matter was laid aside, and eventually abandoned owing to the pressure of other work. We cannot help regretting that these circumstances prevent us from associating the name of Professor Davis with this handsome species.

Ashmead also named many species of *Andrena* which he did not publish. When I visited him, during his most active period, at the U. S. National Museum, I took down the names of 32 species which he proposed to publish. So far as I know, he never actually described any of them in detail, though he had studied them a good deal. The four species from Colorado, which Ashmead described under the genus *Cilissa* in 1890, are all valid and well known They were based on specimens which I collected in Wet Mountain Valley.

The species of *Andrena* are very frequently oligotropic, or at least restricted to a limited number of plants for their supply of pollen. This has certainly been a contributing cause to the multiplicity of species, and their often limited range. One of the most interesting cases is that of *A. parnassiæ* and *A. peckhami*, closely studied by Graenicher. They are extremely closely related, and might well have been considered variants of a single species, but for their habits. *A. peckhami* Cockerell visits Compositæ and appears with the early flowers of *Helianthus; A. parnassiæ* Cockerell is an oligotropic visitor (in the same region in Wisconsin) of *Parnassia caroliniana*, and flies considerably later, from August 25 to September 26, during the flowering period of the *Parnassia.* There can be little doubt that *A. parnassiæ* was derived from *A. peckhami*, but it is now a perfectly valid species. The willow-visiting species of *Andrena* seem, as a rule, not to discriminate between species of *Salix*, but there is one species, *A. nigræ* Robertson, which Robertson found only on *Salix nigra.* Graenicher, in his Wisconsin list, catalogues five species of *Andrena* which gather pollen from *Salix*, ten from the Compositæ, four from Umbelliferæ, and one each from *Claytonia virginica*, *Hydrophyllum*, *Geranium maculatum, Fragaria,* and *Parnassia.* *A.* (*Iomelissa*) *violæ* Robertson is entirely restricted to the genus *Viola.*

Little has been recorded concerning the occurrence of more than one annual brood in American *Andrena.* Viereck found that *A. fulvipennis* Smith, described from Florida but extending up the coast to New Jersey, has two broods, flying in May and September (Entom. News, Oct., 1902). Viereck has recorded *A. kincaidii* Cockerell, of the Pacific Northwest, as occurring from April to July, and again late in September, but whether there is a regular fall brood remains to be ascertained. Of *A. pulverulenta* Viereck, it is stated that the male was collected May 15, the female September 25, but we may be permitted to question the association of the sexes The Colorado species *A. vierecki* Cockerell flies in spring, but a female was taken at Boulder, August 24. Robertson, from his exhaustive studies in Illinois, separates the vernal species definitely from the autumnal. Referring to his segregated genera (which I treat as subgenera), he states (1902), "All of the genera mentioned here are vernal, except *Andrena* and *Pterandrena. Andrena* is vernal, with the exception of *A. nubecula. Pterandrena* is autumnal, with the exception of *P. lauracea, krigiana* and *rudbeckiæ.*" Perkins (1919) found that in England *A. tibialis,* one of the earliest spring bees, was always single-brooded; while the very closely related *A. bimaculata* was double-brooded. *A. wilkella* and *A. ovatula* are also very closely related species, the former single-brooded, the latter double-brooded. Several species regularly produce a second brood in the south of England. Perkins adds: "In northern Europe species which with us, even in the extreme south of England, are invariably single-brooded produce a second brood in summer, the first brood often appearing earlier than our one brood of the same species." It is stated that *A. sericea* even has a third brood. Thus it cannot be said of a species that it is single-brooded, without qualification, until we know it in all parts of its range; but the number of broods differs in different species under the same environment.

An interesting form of variation in *Andrena* has to do with the replacement of red by black, or vice versa. Thus, in our own fauna, *Andrena prunorum* Cockerell has a black race, *arizonensis* Viereck and Cockerell, which looks like, and was first described as, a distinct species.[1] This kind of variation is more or less racial, and Friese has listed no less than nineteen Old World species in which there are two varieties or races, one with black abdomen, the other with the abdomen more or less red. In some cases the dark form is the typical one of the species, in others it is the rufous one.

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[1] Even at Boulder, Colorado, a black form of *A. prunorum* is occasionally found. The insect named *arizonensis* is a little different, being more finely punctured. But later I received *arizonensis* from Santa Monica, California, and renewed study caused me to treat it as a race of *prunorum* (Pan-Pacific Entomologist, October, 1924, p. 57). Ordinary *A. prunorum* also occurs in California.

There are many species of *Andrena* which have light tegumentary markings on the face in the male and some also in the female. Robertson, in his key (1902), uses this as one of the characters to separate his segregated genera (*Parandrena*, *Opandrena*, and *Pterandrena* having the light face-marks in the male), but shows that *Iomelissa violæ* varies in this respect within the species. In 1912 he wrote me: "Of seven *I. violæ* males, three have no face-marks, two have a dot on each lower corner of face, one has a dot on one side only, and one has dot on apex of clypeus." The European *A. humilis* Imhoff has the clypeus varying from white to black in the male. The original type had a black clypeus, but the form called *fulvescens* Smith, with white clypeus, is widely distributed over Europe. Morice examined the genitalia of the two forms and found no difference.

Perkins (1919) expressed the opinion that the light male clypeus represented a primitive condition in *Andrena*, but remarked that the British species with this character were diverse, not forming a natural group.

Perkins, after enumerating the eleven groups into which he separated the British species of *Andrena*, observed that even species from California or the Far East (names not specified) could sometimes be referred at once to these groups. Mr. Elven Nelson, in his study of *Andrena hitei*, has clearly shown its relationship to a European species, *A. fulva;* not only in external appearance, but also in the structure of the male. There is plenty of evidence to show that there are various minor groups of *Andrena* common to the Nearctic and Palæarctic regions. These must have crossed over when conditions for such migrations were more favorable, presumably in late Tertiary time. We know from the occurrence of fossils that *Andrena* is ancient in both regions. *A. primæva* Heer manuscript, Cockerell, is from the Miocene rocks of Baden, and there are five species fossil in the Miocene shales at Florissant, Colorado.

For the determination of species of *Andrena*, the male genitalia are often of great service, as the Rev. F. D. Morice set forth at length in 1899 (Trans. Ent. Soc. Lond., June, 1899, pp. 22[illegible]-252). Morice used not only the genital armature, but also the last two sternites. By the study of these structures he was able to separate from *A.*

taraxaci Giraud two new species, *A. curtivalvis* and *A. stabiana*, which otherwise would hardly have been recognized as distinct. But once having established their distinctions, he was able to tabulate the females also, showing them to possess minute but quite visible specific characters. In our Rocky Mountain fauna, extensive studies of *Andrena* genitalia and sternites have been made by Mr. Elven Nelson, as will later appear. At the same time, Mr. Cecil Williams has studied the mouth-parts, finding excellent characters, likely to be especially useful in associating the sexes.

It will be readily understood, from the facts already stated, that many species of *Andrena* are highly "critical," while others run into various local races. Even in Central Europe, where so much attention has been paid to the subject, several new species have been described in quite recent years. The only way to understand rightly the complexities of this large genus is to group the species according to their affinities and present the differential characters in tables or keys. Long descriptions are not nearly so valuable as accurate comparisons with related species, but, on the other hand, we must deplore the introduction of new species in abbreviated keys with so little information that it is largely guess-work to determine what was intended. Even the best work on a single limited fauna has its disadvantages, owing to the fact that, while the various species may be clearly diagnosed from one another, it is difficult or impossible to know what characters will separate those forms from the races or close allies to be found in adjacent or distant regions. To a certain extent this vitiates all of our work on North American *Andrena* at present. We do not possess the materials for an adequate treatment of any group of the genus, as it occurs throughout its range. It is not desirable to hold up the work until such materials may be forthcoming, probably at some distant date, when they have been collected with a definite purpose in view. We can only point out that here is a vast undertaking for some future worker or workers, who will necessarily have to revise much of the work previously done, and of course add greatly to it.

The following records of *Andrena* are based on specimens in The American Museum of Natural History. These were collected by the Rocky Mountain expeditions of Dr. Frank E. Lutz, unless the contrary is specified. In spite of all that has been published, they add much to our knowledge, especially concerning the distribution of the species.

Andrena accepta Viereck

COLORADO.—Wray, ♀, Aug. 17; ♂, Aug. 14–19. At *Helianthus*. La Junta, ♂, Aug. 12.

UTAH.—Ogden, ♂, Aug. 29–30.

Andrena albihirta (Ashmead)

COLORADO.—Long's Peak Inn, June 16, 1922, ♀. At *Salix*.

This is a late date for the species, but the altitude is about 9000 ft. The specimen is unusual on account of the strongly reddened stigma and the very broad second cubital cell. *A. cockerelli* Graenicher can be distinguished from *A. albihirta* by the broader, pure black abdomen; that of *albihirta* appears by contrast a little greenish, though not actually green. What I have as male *A. cockerelli* from Boulder, Colorado, has the abdomen slightly greenish and is, I now believe, distinct from the Wisconsin species. More critical is the separation of *A. perarmata* Cockerell from *A. albihirta*. The male differs from Ashmead's species by the mandibles being strongly toothed beneath; but the females are so much alike that we may wonder whether the male is variable in respect to the tooth.

Andrena albosellata, new species

FEMALE.—Length about 10.5 mm., anterior wing 8.2 mm.; black, the thorax above with dense stiff not very long white hair, and long white hairs forming a band at the top of the occiput; the light hair is also found on tubercles and metathorax, but the vertex, front, face, cheeks and mesopleura have black hair; facial quadrangle broader than long; malar space linear; process of labrum deeply emarginate; antennæ black, third joint about twice as long as fourth; disc of clypeus shining, with scattered strong punctures, and a rather ill-defined median smooth band; front finely striate; facial foveæ entirely dark, separated above from ocelli by fully as much as width of an ocellus, ending below at level of top of clypeus, separated only by a shining line from eye; mesothorax dull, a little shining posteriorly, the punctures so small as to be hardly visible under a lens; scutellum like hind part of mesothorax; area of metathorax dull, without evident sculpture; tegulæ small, shining black; wings dusky; stigma narrow, reddish with dark margin; basal nervure falling short of nervulus; second cubital cell about square, receiving recurrent nervure at about beginning of last third; legs with black hair; abdomen moderately shining, not banded, the punctures minute and inconspicuous; first two tergites with long white hair, but some black at sides of first, and almost the lateral thirds of second with black; beyond this the hair is rather abundant, and black; second tergite in middle depressed hardly a third. In the Wyoming specimens the black hair on tergites is shorter, and there is long white hair on under side of hind femora, but I consider them to belong to the same species.

COLORADO.—Pagosa Springs (type locality), 7500 ft., June 21–23, F. E. Lutz, collector.

WYOMING.—Stewart Ranger Station, July 18, 1920, 6700 ft. Two specimens.

This is so much like *A. bebbiana* Viereck and Cockerell that it might be thought identical were it not that *bebbiana* flies at the end of March, and has an entirely different clypeus, dull and very hairy. Compared with *A. edwiniæ*, *A. albosellata* is much smaller, and also separated by the black hair on face. The hair of thorax above is much shorter than in *A. milwaukeensis* Graenicher. The dark tibial scopa separates it from *A. hemileuca* Viereck.

Andrena apacheorum Cockerell

COLORADO.—Tennessee Pass, about 10,500 ft. altitude, ♀, July 30–Aug. 2, Aug. 6–8, Mrs. F. E. Lutz, collector. Ward, ♀, Aug. 8–10. Aspen, ♀, July 24–27. Leadville, ♀, Aug. 3–5, H. F. Schwarz collector.

Andrena argemonis Cockerell

COLORADO.—White Rocks near Boulder, July 30, ♀. At *Cleome serrulata.*

Andrena birtwelli subatrata, new subspecies

FEMALE.—Hair of mesopleura long and black, but that of thorax above creamy-white, extending on to tubercles; hair of front and sides of face abundant and black, but of lower half or more of clypeus creamy-white, or the long hair at sides of face may be white; cheeks with black hair. The facial foveæ are dark; mesothorax dull; wings brownish hyaline; stigma ferruginous or fulvous with heavy dark margin; second cubital cell receiving recurrent nervure much beyond middle; hair of hind tibiæ and tarsi black or dark, but basitarsi with a little pure white tuft at tip; abdomen without bands, apical fimbria black. There is long white hair on the first tergite, whereas *A. clypeoporaria* Viereck and *A. hemileuca* Viereck have pale hair on the first two tergites. From *A. merriami* Cockerell it is easily distinguished by the much larger depression of second tergite and less shining abdomen. It is a melanic form of *A. birtwelli* Cockerell, apparently constant where it occurs.

COLORADO.—Tennessee Pass (type locality), 10,500 ft., Aug. 6–8, 1920, Mrs. F. E. Lutz, collector. Also same locality and date, July 30–Aug. 2, 1919. Aspen, July 24–27, 1919, 8000 ft., H. F. Schwarz, collector (three specimens).

WYOMING.—Stewart Ranger Station, July 18, 1920, 6700 ft.

Andrena (Trachandrena) brevibasis, new species

FEMALE.—Length about 10 mm., anterior wing about 9; a species with bright red abdomen, and so close to *A. mariæ* Robertson that it is best defined by comparison with it. Compared with *A. mariæ* (from Ames, Iowa, and Long's Peak Inn, Colorado) the mesothorax anteriorly is more shining and less closely punctured; the stigma is larger and duller red; the area of metathorax is much more finely sculptured (the fine plicæ, to the number of about twenty-five, evanescent apically in middle portion, and generally so weak that it is necessary to look closely to see the *Trachandrena* character); the pale golden depressed part of first tergite practically impunctate (distinctly punctured in *mariæ);* the second tergite depressed nearly to base, leaving only a very narrow basal elevated band, not half as broad as in *mariæ;* depression of third tergite also much more extensive; hair on inner side of hind basitarsi light reddish (dilute chocolate in *mariæ*). There is no trace of white hair-patches at sides of abdomen. Wings reddish hyaline, basal nervure meeting nervulus; second cubital cell high, receiving recurrent nervure well beyond middle. Face somewhat broader than in *A. mariæ;* mandibles red at tip; process of labrum broadly rounded, subtruncate; tarsi and hind tibiæ rather dusky red; flagellum entirely dark, with no red band beneath.

WYOMING.—Green River, July 2, 1920, alt. about 6100 ft., F. E. Lutz, collector.

Andrena bruneri Viereck and Cockerell

WYOMING.—Laramie, June 14, 1920, altitude 7200 ft., three specimens.

A. hicksi is very closely allied, but is distinguished by the more shining very dark purplish abdomen; the area of metathorax more narrowed apically, with a slightly shining margin; and the very broad second cubital cell.

Andrena (Trachandrena) corrugata, new species

FEMALE.—Length about 10.3 mm.; black, including antennæ and legs (the basitarsi brownish); hair of head and thorax long and loose, sordid white, faintly yellowish above, especially in region of tubercles; head ordinary, face broad; red hair on under side of head in region of mouth; process of labrum broadly truncate; malar space linear; clypeus convex, shining, with no smooth line, apical portion with well separated punctures, but basally the strong punctures are dense; supraclypeal area closely punctured; front densely punctured; third antennal joint hardly as long as next two together; facial foveæ grayish white, separated above from ocelli by a shining space about as wide as an ocellus, but below narrowed, and separated from eyes by a rather broad shining band (the narrow lower end of facial fovea, well separated from orbit, at once distinguishes the species from *A. semipunctata* Cockerell); cheeks with abundant long hair; mesothorax dull, densely and strongly punctured, with a smooth median line; scutellum more shining, but strongly punctured, with no median sulcus; area of metathorax dull, with strong coarse rugæ; mesopleura dull, without evident sculpture; tegulæ piceous, with a red spot on outer side; wings brownish hyaline; stigma well developed but rather narrow, very dark brown; basal nervure meeting nervulus; second cubital cell large, about square, receiving recurrent nervure a little beyond middle; third cubital somewhat narrower on marginal than second; legs with pale hair, the scopa of hind tibiæ very pale fulvous; hair on inner side of hind basitarsi copper-red; spurs red; abdomen broad, convex, without bands, but a little pale marginal hair at sides of tergites two to four; tergites dullish, finely and weakly punctured, second tergite in middle depressed about three-fifths, fourth depressed more than half; apical fimbria fulvous; hind margins of tergites very narrowly brownish.

WYOMING.—Jackson, July 13–17, 1920, about 7000 ft., F. E. Lutz, collector.

Distinguished from *A. indotata* Viereck by much darker stigma, and larger, more strongly sculptured metathoracic area. From *A. lincolni* Viereck and Cockerell it is known at once by the color of the legs and the much larger second cubital cell. The area of metathorax is quite unlike that of *A. moscovensis* Viereck and Cockerell. I have not seen *A. amphibola* Viereck, from Oregon, but it is evidently distinct by the brownish foveæ, and the rugose mesothorax without distinct punctures. In *A. corrugata* the mesothorax posteriorly has very distinct punctures running in oblique rows.

Andrena costillensis Viereck and Cockerell

COLORADO.—Ward, ♀, Aug. 8–10. Leadville, ♀, Aug. 3–5. Tennessee Pass, ♀, July 30–Aug. 2. About 11,000 ft. altitude.

Andrena (Trachandrena) cyanophila Cockerell

COLORADO.—Tennessee Pass, 10,500 ft., Aug. 6–8, and about 10,300 ft. altitude, July 30–Aug. 2. Electra Lake, eight specimens, June 28–July 1, at *Potentilla filipes.* Cornet Creek, Telluride, about 10,000 ft., July 9. All females.

WYOMING.—Jackson, about 6300 ft., July 13–17.

The specimens from Tennessee Pass and Electra Lake have the hair on inner side of hind basitarsi darkened. I thought at first to separate them, but on close comparison there is no satisfactory basis for a distinctive name.

Andrena (Trachandrena) eriogoni Cockerell

COLORADO.—Glenwood Springs, ♀, Aug. 5, 1920, Mrs. F. E. Lutz, collector.

IDAHO.—Montpelier, ♀, July 6, about 6100 ft

The clypeal ridge varies, and may be distinct or evanescent.

Andrena erythrogastra (Ashmead)

COLORADO.—Julesburg, ♀, about 3460 ft., June 7. Nine specimens. At *Salix.*

Andrena hallii Dunning

FEMALE.—Length about 13 mm.; black, with hair of thorax above, including tubercles, bright fox-red, very dense and mosslike; between the wings, the hair is thinner, so that looked at from above there is the appearance of a black band, and there are in fact some scattered dark hairs on hind part of mesothorax and on scutellum; the occiput has pale fulvous hair, but on the rest of the head it is black, sometimes appearing grayish on the clypeus; hair of pleura black, of metathorax mainly black, but partly pale at sides; legs and abdomen with black hair; tegulæ black; wings fuliginous, with dark brown nervures, and small but not lancellate dark reddish stigma with dark margin. Process of labrum broadly truncate (Dunning says emarginate for *A. hallii*, but I found it truncate); clypeus brilliantly shining, with shallow close punctures and a weak median ridge; facial foveæ dark chocolate, reaching orbits of lateral ocelli; antennæ black, third joint about or nearly as long as next two combined; mesothorax densely punctured, moderately shining posteriorly, but not polished; area of metathorax small, triangular, the marginal area thickened and somewhat shining, forming a thick V, the base not at all plicatulate (as it is in typical *hallii*); second cubital cell very broad, receiving recurrent nervure at or a little beyond middle; abdomen closely and extremely finely punctured on a tessellate surface (as in *hallii*); second tergite in middle depressed about a third; caudal fimbria and long hair on venter black. Median line of clypeus not distinctly tessellate.

WYOMING.—Rock Springs, ♀, June 29, 1920, about 6500 ft., six specimens. Cheyenne, ♀, June 11, 1920, about 6000 ft. altitude, one specimen. Rawlins, ♀, June 26, 1920, 6800 ft. altitude, three specimens.

UTAH.—Eureka, ♀, June 14, 1920, Tom Spalding, collector.

Dunning described *A. hallii* from Pullman, Washington, and Moscow, Idaho. I hereby designate Pullman as the type locality. The species is a very handsome one and quite distinct. I thought at first to treat the Wyoming and Utah form as a distinct race, but on close analysis could find no satisfactory basis for such action. I give a description, based on a specimen from Rock Springs.

Andrena helianthi Robertson

COLORADO.—La Junta, ♀ and ♂, Aug. 12, Mrs. F. E. Lutz, collector. Wray, ♀ and ♂, Aug. 17–19, at *Helianthus*. Boulder, ♀ and ♂, Aug. 7–12.

UTAH.—Ogden, ♀, Aug. 29–30.

Andrena hirticincta Provancher

COLORADO.—Ward, ♀, Aug. 8–10, Pearce Bailey, collector.

WYOMING.—Mountains near Sheridan, ♂, (Metz).

Andrena hitei Cockerell

COLORADO.—Boulder, ♀, May 27–28. June 6, at *Rubus deliciosus* and *Prunus*, probably *melanocarpa*. South Fork of Rio Grande, ♀, June 17, about 8500 ft. altitude.

Andrena johnsoniana Cockerell

Described from a female taken on Johnson Mesa, New Mexico, July 7. It had been suggested that it was identical with *A. cressonii* Robertson, and I asked Miss Sandhouse to examine the unique type in the U. S. National Museum. It is quite distinct from *A. cressonii* by the following characters:

Front punctostriate (in *cressonii* densely and deeply punctured with a medial polished streak above the carina extending to anterior ocellus); punctures of mesoscutum more shallow and widely separated on middle of disc; propodeum dull and more coarsely sculptured; second cubital cell higher than broad, receiving recurrent nervure very near apex (in *cressonii* it is as broad as long, and receives recurrent nervure near middle); third cubital cell on marginal almost equal to 1+2 (in *cressonii* the third is about equal to first); abdominal tergites less densely and distinctly punctured; apical fasciæ of tergites in type badly worn, but apparently originally not so dense.

Andrena lupinorum Cockerell

COLORADO.—Ward, June 25.

WYOMING.—Camp Roosevelt, Yellowstone Park, July 14–17, E. L. Bell, collector.

Andrena (Trachandrena) lutzi, new species

FEMALE.—Length about 11 mm., anterior wing 9.3 mm.; robust, black, except the upper side of abdomen, which has strong purple and green colors; hair of head black, scanty; of thoracic dorsum and tubercles creamy-white, the hairs stiff, erect, and thick; pleura with black hair, sides of metathorax with gray; hair of legs and abdomen black, the latter without bands; process of labrum broadly truncate, not emarginate; third antennal joint about as long as next two together; flagellum entirely black; clypeus excessively coarsely and densely punctured, with a median smooth ridge; malar space very short; cheeks shining; facial foveæ purplish gray, very broad above, almost reaching lateral ocelli, narrowed below to an obtuse point slightly below level of antennæ. with a shining band between foveæ and orbits; mesothorax and scutellum dull, with very large but not very dense punctures; area of metathorax strongly longitudinally plicate, with a transverse ridge posteriorly; mesopleura very coarsely rugose, with a tuberculate effect; spurs black; tarsi rufescent at tips; tegulæ black anteriorly, posteriorly dark brown; wings brownish hyaline, violaceous, stigma large, dark reddish-brown, nervures dark fuscous; basal nervure meeting nervulus; second cubital cell small, receiving recurrent nervure well beyond middle; abdomen with a microscopical sculpture of very fine transverse lines, on first tergite also with a minute tessellation, but raised portions of tergites smooth, with rather sparse strong punctures; the apical depressions occupy most of the tergites, even the first, leaving broad elevated laterobasal area, narrowly connected across the middle, the second tergite depressed practically to the basal transverse ridge over which the first slides; venter very finely and densely punctured, the margins of the sternites narrowly testaceous. The facial quadrangle is much broader than long.

WYOMING.—Stewart Ranger Station, about 6700 ft. altitude, July 18, 1920, F. E. Lutz, collector.

A very remarkable and distinct species, nearest to *A. cleodora* Viereck, but easily separated by the light hair on thorax above.

Andrena mariæ Robertson

COLORADO.—Boulder, ♀, May 24, at *Salix*, M. D. Ellis, collector. Julesburg, ♀, June 7, at *Salix*, abdomen considerably darker than in the Boulder one.

Andrena mentzeliæ Cockerell

Colorado.—Grand Junction, ♂, Aug. 3; ♀, Aug. 3. Apparently asleep in squash flowers at 9:30 a.m. Jim Creek, near Boulder, ♀, July 8, Mrs. F. E. Lutz, collector. Pueblo, ♀, Aug. 9.

Andrena mustelicolor Viereck

Idaho.—Bear Lake, July 9, ♀. Superficially, this looks like *A. nubecula* and *A. sieverti.*

The three (females) are readily separated thus:

1.—Second cubital cell receiving recurrent nervure about middle; wing with no apical cloud; scutellum entirely dull......................*mustelicolor* Viereck.
  Second cubital cell receiving recurrent nervure well beyond middle, or not far from end...2.
2.—Stigma very dark; wing with a conspicuous apical cloud......*nubecula* Smith.
  Stigma light ferruginous; scutellum highly polished........*sieverti* Cockerell.

Andrena nigerrima pineti, new subspecies

Female.—Like *A. nigerrima* Casad (which has been taken as far north as Sioux County, Nebraska, in May, L. Bruner, collector) but somewhat smaller and less robust; process of labrum small, truncate (more pyramidal in outline in *nigerrima*), disc of mesothorax much more shining.

Wyoming.—Pine Bluffs, ♀, June 9, 1920, altitude 5050 ft., F. E. Lutz, collector. Two specimens.

Perhaps a distinct species. Among the black species with black hair it is known by the short malar space, the rather small size (anterior wing 7.5 mm.), the clypeus polished on disc, and the narrow dull ferruginous stigma with dark margin. The third antennal joint is conspicuously longer than the next two together. It is considerably smaller and less robust than *A. irana* Cockerell, and as in *A. nigerrima,* has the depressed part of second tergite distinctly brown.

Andrena nubecula Smith

Colorado.—Wray, ♀, Aug. 17–19.

Andrena pertarda Cockerell

Colorado.—Meadows, Estes Park, ♀, Aug. 17. Ridgway, ♀, July 15, H. F. Schwarz, collector. Ward, ♀, Aug. 8–10.

The following key separates the females of a number of species flying in late summer and autumn:

1.—Hair of thorax bright fox-red; wings brown; abdomen with red hair-bands. *vulpicolor* Cockerell.
  Hair of thorax yellow or grayish, not red..2.
2.—Caudal fimbria black, or grayish or brownish black...........................3.
  Caudal fimbria pale...6.

3.—Abdomen without evident hair-bands; hair on tubercles pale reddish; clypeus with a strong median carina . . .*semirufa* Cockerell (New Mexico).
Abdomen with very distinct hair-bands.......................4.

4.—Smaller (anterior wing about 7.3 mm.); clypeus shining, with a smooth ridge or band; second cubital cell about square, receiving recurrent nervure much beyond middle..............................*apacheorum* Cockerell.
Larger; clypeus without a smooth ridge or band...................... 5.

5.—Abdominal hair-bands white, rather narrow; second cubital cell very large and broad...........................*barberi* Cockerell (New Mexico).
Abdominal hair-bands very broad, yellowish; second cubital cell ordinary; stigma light ferruginous.........................*pertarda* Cockerell.

Three other species are closely related, and are distinguished thus:

Very like *pertarda*, but differs by black hair of middle and hind tibiæ and tarsi, and wings without a dark apical cloud; also, the facial foveæ are more or less reddish at upper end . . . .*hirticincta* Provancher.
Very like *hirticincta* but less robust; hair at apex of abdomen yellow stained with red; hair of hind legs pale yellow. The broad middle tarsi are fringed with yellow instead of black hair; only the small joints of tarsi are reddened; the abdomen appears broadly black between the bands (Pan-Pacific Entomologist, I, p. 60)........................*surda* (Cockerell).[1]
Runs to *pertarda* in table, but differs by black hair at sides of tergites 3 and 4, and also in wings and facial foveæ.....................*colletina* Cockerell.

6.—Large species, with abdominal hair-bands thin and inconspicuous. *haynesi* Viereck and Cockerell.
Abdominal hair-bands strong and conspicuous.........................7.

7.—Stigma small, dark reddish; second cubital cell broad, receiving recurrent nervure about middle; hair of scutellum pale yellowish-fulvous. *townsendi* Viereck and Cockerell (New Mexico).
Stigma well developed, clear bright ferruginous; second cubital cell receiving recurrent nervure well beyond middle..............................8.

8.—Larger (anterior wing about 9.3 mm.); clypeus highly polished, hardly punctured in middle..............................*mentzeliæ* Cockerell.
Smaller; clypeus well punctured all over..... *costillensis* Viereck and Cockerell.
Similar to *costillensis*, but mesothorax smooth and brilliantly shining; flagellum red beneath...........................*ramaleyi* Cockerell (Colorado).

The males of some of the above, the clypeus with dark tegument, and the abdomen with very distinct hair-bands, are separable thus:

1.—Hair of thorax white, with little or no yellow tint; stigma deep ferruginous, more or less narrowed basally; scutellum shining anteriorly............2.
Hair of thorax strongly yellow; stigma clear orange-ferruginous, hardly or not narrowed basally..3.

2.—More robust; abdominal bands dense and white (August, at Compositæ). *costillensis* Viereck and Cockerell.

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[1] The female referred to *A. surda* came from California; the species was described from the male, which has been taken in Colorado and Wyoming. Thus, the identification of the female, while apparently correct, may be subject to revision.

Less robust; abdominal bands narrower, and grayish. . . . *apacheorum* Cockerell.

3.—Hair of abdomen bright yellow; hind tarsi red; scutellum shining *surda* (Cockerell).

Hair of abdomen pale or ochreous. . . . . .4.

4.—Larger (anterior wing 8.5 mm.); scutellum dull, only shining along anterior margin; abdominal tergites 4 and 5 with black hair before the band. *colletina* Cockerell.

Smaller; scutellum shining; abdominal tergites 4 and 5 without black hair. .5.

5.—Supraclypeal area highly polished; first recurrent nervure joining second cubital cell little beyond middle; nervures ferruginous. . . . . . *mentzeliæ* Cockerell.

Supraclypeal area rough and dull; first recurrent nervure joining second cubital cell well beyond middle; nervures fuscous. . . . . *hirticincta* Provancher.

Andrena porteræ Cockerell

COLORADO.—Apex Canyon, Golden, ♂, May 1, 1921 (L. O. Jackson).

WYOMING.—Pine Bluffs, ♀, June 9, 5050 ft. altitude.

Andrena (Trachandrena) postnitens, new species

FEMALE.—Length 10 mm. or slightly over; black, the hair of head and thorax white, long and outstanding on mesopleura; head broad, facial quadrangle broader than long; malar space short but distinct; mandibles reddish at end; process of labrum broadly rounded, shining; clypeus convex, densely rugose-punctate, dullish, without any trace of a smooth line, the upper three-fifths of clypeus somewhat shining and distinctly punctured, the lower two-fifths dull, the sculpture hardly visible under a lens; supraclypeal area and sides of face shining; front striate; facial foveæ clear white, broad above, approaching lateral ocelli, ending obtusely at level of top of clypeus, the lower part separated from eye by a narrow shining band; antennæ entirely black, third joint about as long as next two together; vertex dull; cheeks with a broad shining band behind the eyes, but otherwise dull; mesothorax shining, strongly punctured, but punctures on disc very sparse, median sulcus deep; scutellum shining, sparsely but strongly punctured, with a median sulcus; area of metathorax dull, the rugæ distinct but not very strong, toward the middle irregular and forked, but a strong median keel; mesopleura shining above, dull below, minutely rugulose; tegulæ black, reddish brown posteriorly on margin; wings dusky hyaline, somewhat reddish; stigma large, dull ferruginous, not dark margined; nervures dull ferruginous; basal nervure meeting nervulus; second cubital cell large, oblique, receiving recurrent nervure near beginning of last third; legs black, with small joints of tarsi rufous; hair of legs mainly white, but red on inner side of basitarsi, and inner face of anterior tibiæ; scopa of hind tibiæ white, dense; spurs red; abdomen highly polished, as if oily, not evidently punctured, hind margins of tergites more or less rufescent; second, third, and fourth tergites in middle depressed almost to base; no hair-bands; apical fimbria pale, partly fulvous; venter with thin bands of long white hair.

WYOMING.—Stewart Ranger Station, about 6700 ft., July 18, 1920, F. E. Lutz, collector.

Closely resembles *A. politissima* Cockerell from Idaho, but larger, and the white facial foveæ broader above, separated from lateral ocelli by about half the width of an ocellus; while in *A. politissima* the foveæ are yellowish, and separated from ocelli by about width of an ocellus. There are several other differences. From *A. nuda* Robertson it is known by the quite different metathorax and the elevations at sides of second tergite rounded (not pointed) posteriorly. The metathorax is also quite different from that of *A. multiplicata* Cockerell. In my manuscript key it runs nearest to *A. cyanophila* Cockerell, but is at once separated by the more extensively depressed second tergite. It lacks the patches of white hair at sides of abdomen seen in *A. semipunctata* Cockerell, which also has a dull mesothorax.

Andrena prunorum Cockerell

COLORADO.—Boulder, June 30, ♀, at *Petalostemon.* Glenwood Springs, ♂, July 22–29; ♀, Aug. 5, H. F. Schwarz and Mrs. F. E. Lutz, collectors. Jim Creek, near Boulder, ♀, Aug. 3, at *Argemone platyceras.* White Rocks, near Boulder, ♀, July 30, at *Cleome serrulata.* Palisades, ♂, July 18, at *Melilotus alba.*

WYOMING.—Rawlins, ♀, June 26. Medicine Bow, ♀, June 23.

UTAH.—Eureka, ♀, June 19, July 8, Tom Spalding, collector.

IDAHO.—Bear Lake, ♂, July 9.

Andrena prunorum variety **gillettei** Cockerell

COLORADO.—South Fork, ♀, June 17. Ward, ♀, June 25, at dandelion. Boulder, ♀, May 29. James Denham, collector.

WYOMING.—Jackson, ♀, July 13–17.

A. prunorum belongs to a group with red and black abdomen, separating as follows:

1.—Females..2.
  Males..5.
2.—Clypeus more or less red...3.
  Clypeus black..4.
3.—Scutellum, and postscutellum red; mesothorax red marked with black. *mellea* Cresson.
  Scutellum and postscutellum black........................*prunorum* Cockerell.
4.—Larger; anterior corners of mesothorax broadly and densely covered with red hair, or if the hair is not very red it is conspicuously dense and mosslike; the second tergite is duller........................*argemonis* Cockerell.
  Smaller; anterior corners not thus covered.......*prunorum* Cockerell (variety).
5.—Larger; clypeus black................................*argemonis* Cockerell.
  Smaller; clypeus yellow...............................*prunorum* Cockerell.

Andrena (Trachandrena) rodecki Cockerell

This species, described (female) from Boulder, Colorado, proves to be so close to *A. lincolni* Viereck and Cockerell (described from Lincoln, Nebraska) that it may be only subspecifically distinct. *A.*

lincolni is readily distinguished from *A. rodecki* by the red mandibles and lower margin of clypeus, reddish tegulæ, all the tibiæ (or at least middle and hind ones) red, and better developed hair-bands. A specimen of *A. lincolni* from Lisbon, N. D. (Stevens), differs from the type in having the front tibiæ black.

There are four species with ferruginous stigma, which may be tabulated thus:

1.—Hair overlapping foveæ light brown; thorax dorsally with reddish-brown hair; tegument of legs black (Oxbow, Saskatchewan, F. Knab)....*indotata* Viereck.
  Hair overlapping foveæ white; thorax dorsally with white or creamy-white hair.............. .... .2.
2.—Clypeus strongly glistening, flattened on disc; a rather narrow species. *ceanothi* Viereck.
  Clypeus densely punctured, convex in middle; hind tibiæ and tarsi red.. ...3.
3.—Larger, with very broad abdomen; stigma dark-margined; fourth tergite with an entire pure white hair-band... ....*lincolni* Viereck and Cockerell.
  Smaller, build of *ceanothi;* stigma not dark-margined; fourth tergite with no such band............... .. . . ..*moscovensis* Viereck and Cockerell.

The type of *A. lincolni* was taken in April, but the North Dakota specimen on June 5.

Andrena rufojugata, new species

FEMALE.—Length about 12.5 mm., anterior wing 10.5; black, robust, the head and thorax with stiff fulvous pubescence, becoming bright fox-red on tubercles, anterior part of mesothorax, and scutellum; facial quadrangle somewhat broader than long; malar space linear; mandibles slender in middle; process of labrum broadly truncate, not at all emarginate; eyes with very sparse short hairs (these also present in *A. lupinorum*); clypeus flattish, closely punctured, the punctures running in rows, and with no median smooth line, except toward the apex, where there is a short longitudinal smooth band; flagellum obscurely reddish beneath; third antennal joint fully as long as next two combined; facial foveæ (seen from above) pale grayish, fulvous, broad above, ending below about level of top of clypeus, narrowly separated from orbits; mesothorax dull, granular-punctate, glistening on posterior disc; scutellum finely punctured, glistening, with a strong median sulcus; area of metathorax entirely dull, without evident sculpture; tegulæ dark brown, covered with red hair in front; wings dilute fuliginous, the general effect quite dark; stigma narrow but well developed, dusky rufous; nervures fuscous; basal nervure meeting nervulus; second cubital cell large, receiving recurrent nervure distinctly beyond middle; anterior femora with long pale fulvous hair, but on tibiæ and tarsi it is grayish brown, shining pale yellowish on tibiæ behind, while on inner side of the very thick and large basitarsi it is rufescent; middle and hind legs with dark chocolate-brown hair, but the heavy scopa of hind tibiæ, seen in an oblique light, is shining whitish; spurs red, abdomen broad, shining, very finely and weakly punctured, without hair-bands, though there is some pale hair at sides of first two tergites, and on the third it extends very weakly part way along the margin; hair at sides of fourth tergite black, but apical fimbria warm grayish-red; second tergite depressed about a third; sternites with thin bands of long hairs.

WYOMING.—Jackson, July 13–17, 1920, altitude about 6300 ft., F. E. Lutz, collector.

Very close to *A. lupinorum* Cockerell, but distinguished at once by the entirely pale fulvous hair of mesopleura, pale reddish caudal fimbria, third antennal joint shorter, and no complete median raised line on clypeus.

Andrena sieverti Cockerell

WYOMING.—Stewart Ranger Station, ♀, variety with more or less rufescent mid and hind tarsi, July 18, Mrs. F. E. Lutz, collector.

Andrena (Trachandrena) sphecodina Casad and Cockerell

A female from Colorado Springs, Colorado, at willow, April 22 (W. P. Cockerell), has the white patches of hair at sides of abdomen, characteristic of this species, and must be referred here, although the abdomen is larger and darker than in the typical *A. sphecodina* from New Mexico. I had labeled it *A. mariæ*, variety.

Andrena surda (Cockerell)

WYOMING.—Sheridan (Metz), ♂.

Andrena transnigra Viereck

COLORADO.—South Fork of Rio Grande, 4 ♀, June 17, altitude 8500 ft.

This species has a band of black hair across the middle of the thoracic dorsum; but it is a singular thing that *A. victima* Smith from Albany, N. Y., looked at from above, also seems to have such a band; but there is no black hair, and effect is due entirely to the thinner pubescence allowing the black surface to show. The specimen of *A. victima* referred to, received from the U. S. National Museum, has the light hair of thorax above colored as in *A. transnigra;* but Smith's type, which I examined in the British Museum, has the hair of scutellum quite bright orange-fulvous, all the thoracic hair being of this color, though not everywhere so bright.

Andrena wilmattæ Cockerell

Described in 1906 on the same page as *A. johnsoniana,* the female said to be 8 mm. long. The type is in the U. S. National Museum and Miss Sandhouse reports that it measures about 12 mm. The error

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CORYPHODONTS OF MONGOLIA, *EUDINOCERAS MONGOLIENSIS* OSBORN, *E. KHOLOBOLCHIENSIS* SP. NOV.[1]

By H. F. Osborn and W. Granger

Two superior premolar teeth (Fig. 1) were discovered in 1923 by Andrews and Osborn in the Irdin Manha, Upper Eocene horizon, and were described (Osborn, 1924.626, p. 2)[2] as *Eudinoceras mongoliensis.* They are narrower but otherwise strongly resemble the corresponding premolar teeth (Fig. 8) in *Uintatherium* (=*Dinoceras* Marsh). This resemblance misled the present authors (Osborn and Granger) to believe that one of the horned Dinocerata had been discovered in Mongolia. The name *Eudinoceras* implied an improvement or advance on the corresponding *Dinoceras lucare* premolars (Figs. 5, 8) and the senior writer confidently anticipated (*op. cit.*, 1924.626) that in *Eudinoceras* the premolars would be found to be relatively shorter and broader than in *Dinoceras* and that the *Eudinoceras* skull would be found to be shorter.

In 1923 no cranial or other remains of *Eudinoceras mongoliensis* were found in the Irdin Manha, Upper Eocene, to confirm or to disprove the supposed discovery of Dinocerata, but in the year 1925 Andrews and Granger found in the underlying Kholobolchi formation of the Kholobolchi Nor Basin, two crania (Figs. 2, 6) obviously related to *Coryphodon* rather than to *Dinoceras.* Upon examination the *premolar* teeth of these Kholobolchi crania prove to resemble those of *Eudinoceras mongoliensis,* while the *molar* teeth and crania strongly resemble corresponding parts in *Coryphodon.* Accordingly W. D. Matthew, a member of the 1925 expedition, wrote (Peking, May 14, 1926) as follows:

> The coryphodont skulls are magnificent specimens and I think are quite nearly related to *Eudinoceras*, but a stage more primitive if, as would now seem likely, *Eudinoceras* is a descendant of *Coryphodon.* It is a bit strange to me that no trace of a foot bone of an amblypod has been found in the Mongolian Eocene.

Thus *Eudinoceras* represents a new phylum of the family Coryphodontidæ rather than a phylum of the Uintatheriidæ (including *Dino-*

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[1] Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 107

[2] Osborn, H. F., 1924.626. *Eudinoceras*, Upper Eocene Amblypod of Mongolia. Amer. Mus. Novitates, No. 145, Nov. 10, 1924, pp. 1–5, text figs. 1, 2.

ceras). Remains of these new coryphodonts are relatively rare, for on the expeditions of 1923 and 1925 only eight specimens were discovered, geologically distributed as follows:

UPPER EOCENE HORIZONS OF EASTERN MONGOLIA
(OSBORN, 1930.832[1])

Ulan Shireh, 150′+ Shara Murun Basin	*Eudinoceras kholobolchiensis*, ref.	Left superior canine, Amer. Mus. 26276 (Fig. 7).
	Eudinoceras kholobolchiensis ref.	Second right inferior molar, r.M_2, Amer. Mus. 26130 (Fig. 10).
	Eudinoceras kholobolchiensis ref.	Fragment of supratemporal crest of cranium (Field No. 638).
Irdin Manha, 100′+ Iren Dabasu Basin	*Eudinoceras mongoliensis* Osb.	Type: Fourth left superior premolar, l.P^4, Amer. Mus. 20101 (Fig. 1). Paratype: Fourth right superior premolar, r.P^4, Amer. Mus. 20102 (Fig. 1). Referred: First right superior premolar, r.P^1, Amer. Mus. 20134 (Fig. 9).
Kholobolchi, 250′± Kholobolchi Nor Basin	*Eudinoceras kholobolchiensis* sp. nov.	Type: Complete cranium with imperfect dentition, probably female, Amer. Mus. 21744 (Figs. 2, 6). Paratype: Upper portion of larger cranium, probably male, Amer. Mus. 21745 (Figs. 2, 6).

The Andrews-Granger expedition of 1930 has added to the above the remains of eight coryphodonts, which greatly extend our knowledge of the evolution of the Coryphodontidæ in Mongolia. The surprising new discovery is that the coryphodonts survived as companions of the giant titanothere *Baluchitherium* to an horizon above the summit of the Eocene (Baron Sog formation).

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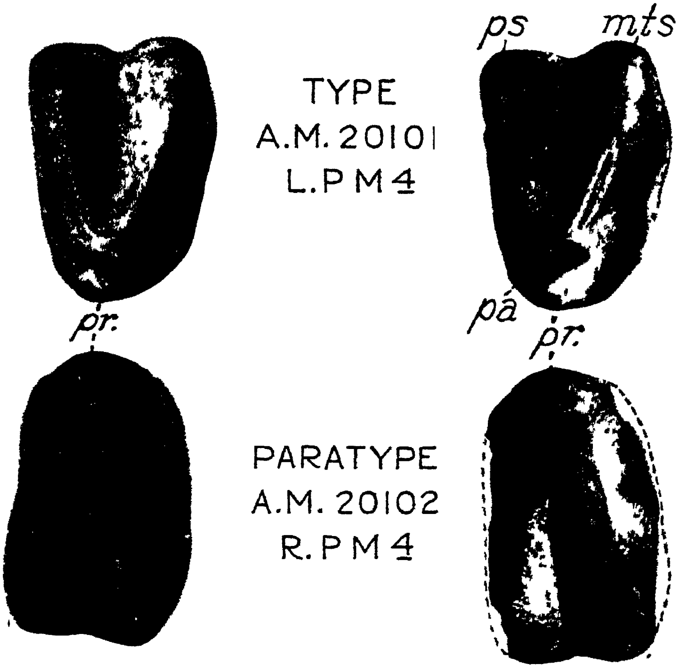
[1] Osborn, H. F., 1930.832 Ancient Vertebrate Life of Central Asia. Discoveries of the Central Asiatic Expeditions of the Museum of Natural History in the Years 1921–1929. "Livre Jubilaire publié à l'occasion du Centenaire de la Société Géologique de France, 1830–1930," pp. 519–543.

Eudinoceras mongoliensis Osborn, 1924[1]

Irdin Manha formation, Protitanotherium grangeri life zone, southeastern Mongolia. Type (Amer. Mus. 20101) collected by Andrews June 1, 1923; paratype (Amer. Mus. 20102) collected by Osborn September 15, 1923.

The type (l.P^4) and paratype (r.P^4), i.e., fourth superior premolars of the left and right sides (Fig. 1), misinterpreted by Osborn as belonging to a progressive uintatheriid, prove to belong to a new type of coryphodontid, as shown by comparison with the fourth left and right superior premolars in the geologically older specific stage *Eudinoceras kholobolchiensis* (Fig. 3). The transversely broad and anteroposteriorly compressed type and paratype premolars of *E. mongoliensis* are clearly shown in figure 1 in reversed illumination; this clearly reveals the V-



Type Fourth Superior Premolars, Left and Right

Fig. 1. *Eudinoceras mongoliensis* Osb. Type (upper) and paratype (lower), Irdin Manha formation, collection of 1923. Natural size.

pa, paracone = primary cone; *ps*, parastyle; *mts*, metastyle; *pr*, protocone = secondary ingrowth from the primary paracone.

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[1] See footnote 2 on page 1.

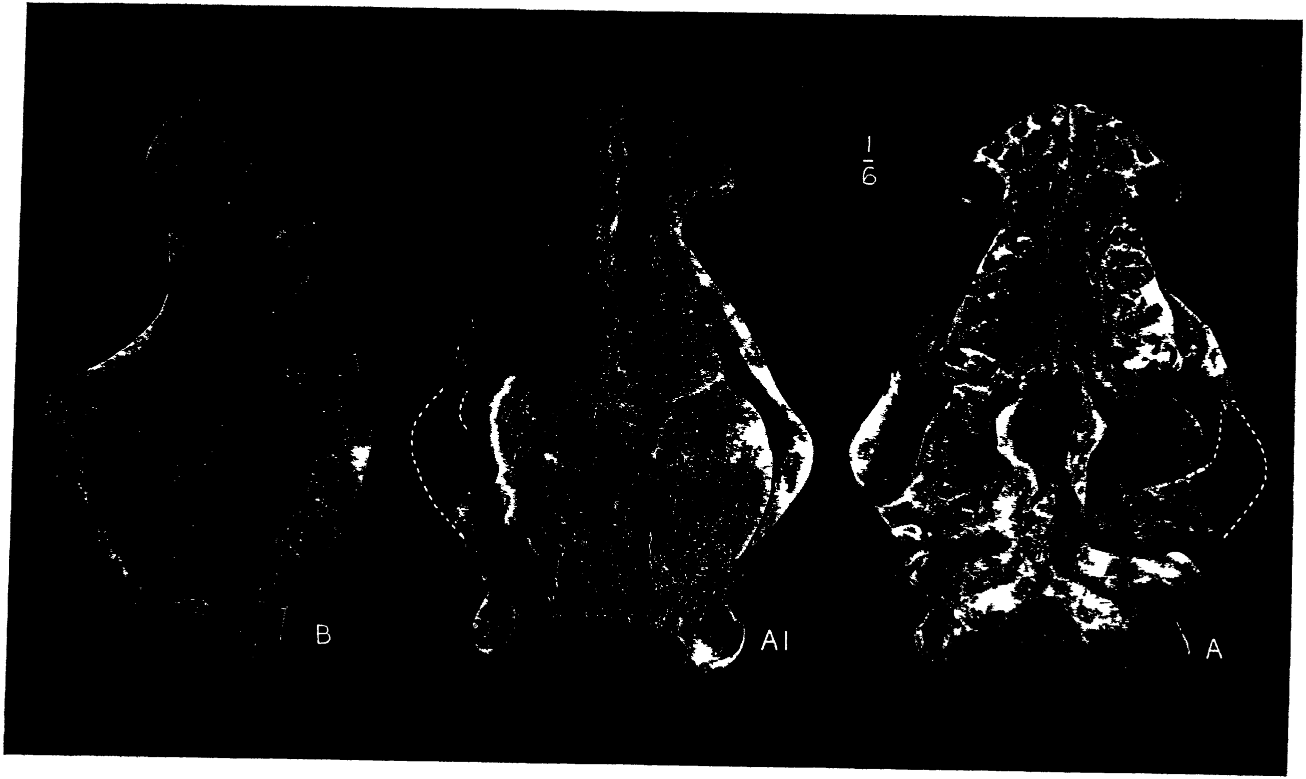

Fig. 2. *Eudinoceras kholobolchiensis.* Type and paratype crania after photographs. One-sixth natural size.

A, A1, Type cranium (Amer. Mus. 21744), superior and palatal aspects. Linear measurement tip of premaxillaries to opening of foramen magnum, 488 mm.; premaxillaries to occipital condyles, 516 mm. This is probably a *female* skull.

B, Paratype cranium (Amer. Mus. 21745). Superior aspect. This is probably a *male* skull.

shaped crests converging to the paracone (*pa*) apex, internal to which is the rudimentary protocone (*pr*); the pre- and postcingular basins are relatively narrow. In the type description and figure (Osborn, 1924.626, p. 2, fig. 2) the type and paratype premolars were transposed; comparison with *E. kholobolchiensis* (Fig. 3) proves that the type of *E. mongoliensis* (Amer. Mus. 20101) is an l.P^4, the paratype (Amer. Mus. 20102) an r.P^4, as correctly shown in the new type figure (Fig. 1).

COMPARATIVE MEASUREMENTS IN MILLIMETERS

	L.P^4			R.P^4		
	ap.	tr.	I.	ap.	tr.	I.
Eudinoceras mongoliensis Osborn						
Type (Amer. Mus. 20101)	26	36	72			
Paratype (Amer. Mus. 20102)				27	41	66
Eudinoceras kholobolchiensis sp. nov.						
Type (Amer. Mus. 21744)	25	40	62	28	39	72
Dinoceras mirabile Marsh						
Type (Yale College Mus. 1036)	23	30	77			
Dinoceras lucare Marsh						
Type (Yale College Mus. 1038)	23	28	82			

Eudinoceras kholobolchiensis sp. nov.

TYPE.—Amer. Mus. 21744. Cranium with nearly complete dentition of both sides, P^1-M^3; crowns of molars, l.M$^{1-3}$, partly fractured, also of r.P^1 and r.P^2; cranium and palate complete; probably female. Figures 2, 3, 6.

PARATYPE.—Amer. Mus. 21745. Upper portion of larger cranium, probably male; palatal dentition entirely wanting. Figures 2, 6.

LOCALITY AND HORIZON.—Kholobolchi formation (250 ft.), Eudinoceras kholobolchiensis life zone, yielding *Eudinoceras kholobolchiensis;* also a small perissodactyl, and unidentified material, mostly fragmentary; Kholobolchi Nor Basin, western Mongolia.

SPECIFIC CHARACTERS.—The superior molars of *Eudinoceras kholobolchiensis* type (Figs. 3 and 6, B5, B3) are much more progressive, i.e., *lophodont*, than those of *Coryphodon testis* (Fig. 4) which are selenolophodont. The premolars of *E. kholobolchiensis* differ widely in the small, conical protocone (*pr*) from those of *C. testis* with a crescentic protocone; they differ from those of *E. mongoliensis* (Fig. 1) in the shallower and less compressed trigon (=*pa, ps, mts*), also in the much larger protocone and pre- and postcingular shelves.

DENTITION

PREMOLARS.—According to the above measurements the type upper premolars (Fig. 3) differ from those of *Eudinoceras mongoliensis* in measurement, proportion, length, breadth, and anteroposterior-transverse index, also in greater prominence of the conical protocone (*pr*);

like the American coryphodonts, e.g., *Coryphodon testis* of Wyoming (Fig. 4), they retain four functional premolars, unlike the uintatheres (*Dinoceras lucare*—Fig. 8) in which only three premolars are retained. The first upper premolar, r.P^1, as shown in the type (Fig. 3) of *E. kholobolchiensis* and in (Fig. 9) *E. mongoliensis* ref., quite closely re-

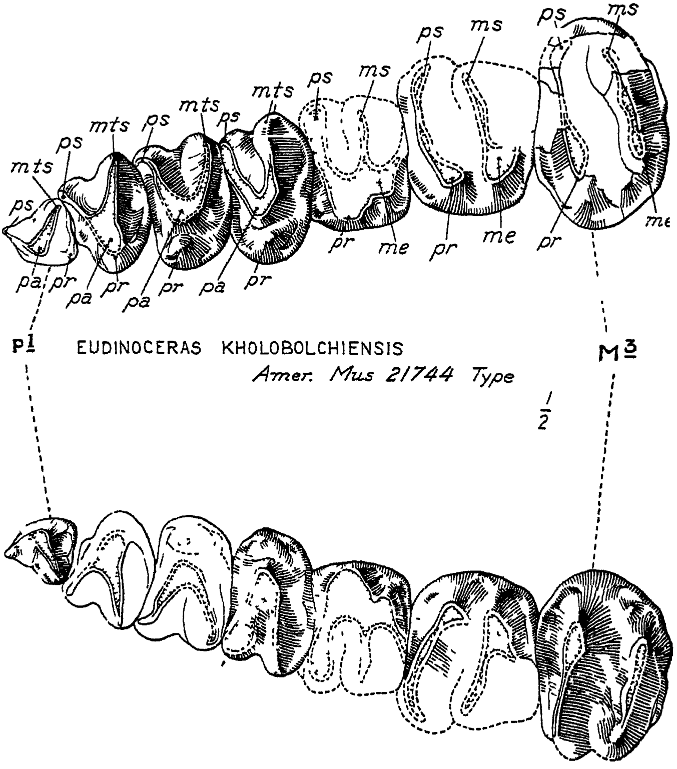

Fig. 3. *Eudinoceras kholobolchiensis* sp. nov. Superior grinding teeth (P^1-M^3) of type skull (Amer. Mus. 21744). One-half natural size.

Cusp Homologies as Determined by Simpson, 1929

pa, primary cone of premolars (probably paracone+metacone).
ps, parastyle (antero-external secondary style).
mts, metastyle (postero-external secondary style).
pr, protocone (secondary internal cone), compare figure 1 (*pr*).
me, metacone (postero-internal cone of molars).
ms, mesostyle (median external style).

Observe that in P^4 of *Eudinoceras kholobolchiensis* the protocone (*pr*) and the internal cingulum are much stronger than in the type of *E. mongoliensis*.

sembles that of *C. testis* (Fig. 4). The other premolars, P$^{2-4}$, present small conical protocones instead of the broad crescentic protocones of *C. testis.*

MOLARS.—The superior molars, M$^{2-3}$, of the type of *Eudinoceras kholobolchiensis* (Fig. 3—½ nat. size) quite closely resemble those of *Coryphodon testis* (Fig. 4—½ nat. size). In M^3, however, the posterior crest (*ms–me*) is much longer and more nearly parallel to the anterior crest (*ps–pr*) than in *C. testis* (*pa–me*—Fig. 4); in none of the Wasatch, Wyoming, coryphodonts is the posterior crest or metaloph so fully developed or lophoid.

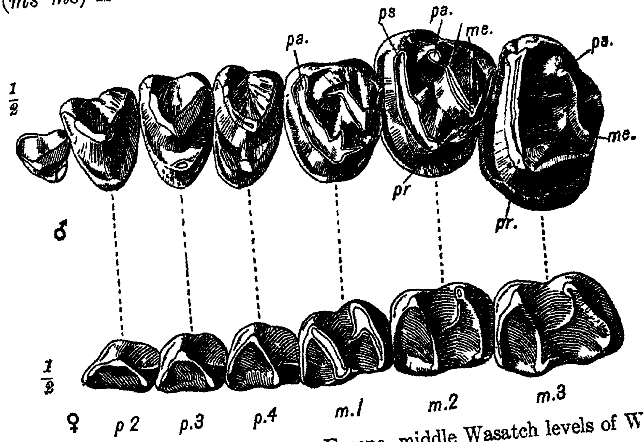

Fig. 4. *Coryphodon testis*, Lower Eocene, middle Wasatch levels of Wyoming. After Osborn, 1898.148, p. 204, fig. 22. One-half natural size.
(Upper) Superior grinding series of the left side, male (Amer. Mus. 274).
(Lower) Inferior grinding series of the right side, female (Amer. Mus. 2868).
The molar and premolar homologies are on the older Cope-Osborn system rather than on the newer Gregory-Simpson system shown in figure 3.

Similarly in the referred inferior molar (Amer. Mus. 26130—Fig. 10) of *Eudinoceras kholobolchiensis* the anterior and posterior transverse crests (pr^d–me^d = protolophid, hy^d–en^d = hypolophid) are parallel, directly transverse, or lophoid.

In brief, the premolars and molars of *Eudinoceras* represent a specific and generic line of evolution independent from that of the American coryphodonts, but, as with the cranium, the premolars indicate that this phylum is much nearer *Coryphodon* than *Uintatherium* (=*Dinoceras*). Finally, this phylum cannot be derived from that of the Lower Eocene

Pantolambda, in which the premolars have crescentic internal protocones, or from the Upper Cretaceous *Protolambda* (Osborn, 1898.148, p. 172[1]), in which the crescentic premolar protocones are strongly developed as in the American *Coryphodon;* consequently the *Eudinoceras* phylum of Coryphodontidæ seems very ancient.

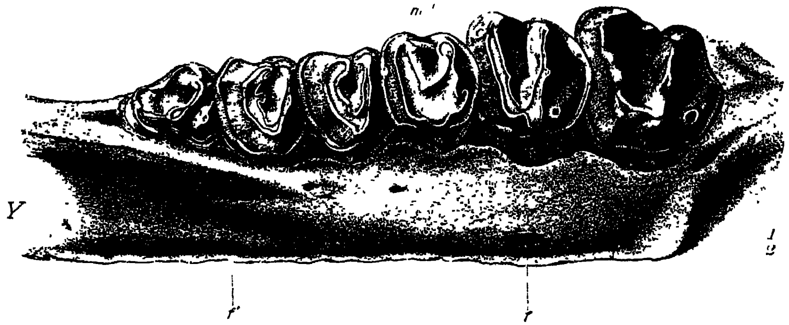

Fig. 5. Superior premolar-molar series, l.P^2-M^3 (P^1 is absent in *Dinoceras*), of *Dinoceras lucare* Marsh. One-half natural size. After Marsh (Monograph of the Dinocerata, 1884, Pl. ix). Compare figure 8.

CRANIUM

The cranium, male and female, is clearly illustrated in superior, palatal, lateral, and anterior aspects (see Figs. 2, 6), so that detailed description is unnecessary. In dimensions it is closely similar (see Osborn, 1898.148, figs. 20, 21) to the next to largest known American crania of the Lower Eocene, namely, *Coryphodon testis* and *C. elephantopus.*

Comparative Measurements in Millimeters

	Coryphodon elephantopus	*Coryphodon testis* Male	*Eudinoceras kholobolchiensis* Type, female, (Amer. Mus. 21744)	*Eudinoceras kholobolchiensis* Paratype, male, (Amer. Mus. 21745)
Length: Premaxillaries to occipital condyles	440e	514	516	570
Breadth: Transverse zygomata			360	
Breadth: Across summit of cranium			230	280

To these major proportions we may add, as a tribute to our late lamented colleague, Dr. William Diller Matthew, a direct citation from

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[1] Osborn, H. F., 1898.148. Evolution of the Amblypoda, Part I. Taligrada and Pantodonta. Bull. Amer. Mus. Nat. His., Vol. X, Art. XI, pp. 169–218.

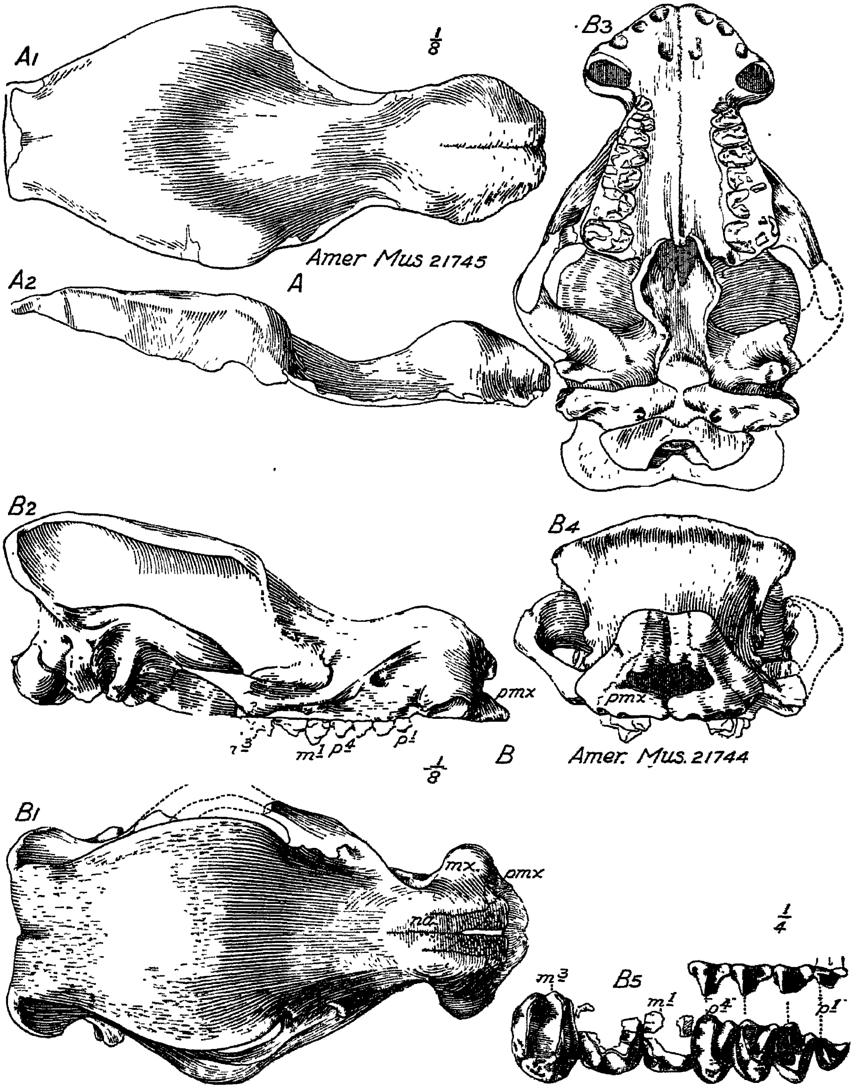

Fig. 6. *Eudinoceras kholobolchiensis.* Type and paratype crania; superior dental series. Crania of uniform one-eighth reduction; teeth one-fourth natural size.

A1, A2, *Eudinoceras kholobolchiensis* paratype (Amer. Mus. 21745). Top and side views of supposed adult *male* cranium (compare Fig. 2B).

B1–B5, *Eudinoceras kholobolchiensis* type cranium (Amer. Mus. 21744).

B1, superior aspect (compare Fig. 2A1).

B2, right lateral aspect.

B3, palatal aspect (compare Figs. 2A and 3).

B4, anterior aspect.

B5, superior dental series (composition of two sides), compare figure 3.

his observations and measurements of the same type cranium of *Eudinoceras kholobolchiensis*, made at the American Museum headquarters in Peking during the winter of 1925–1926 (letter dated May 26, 1926).

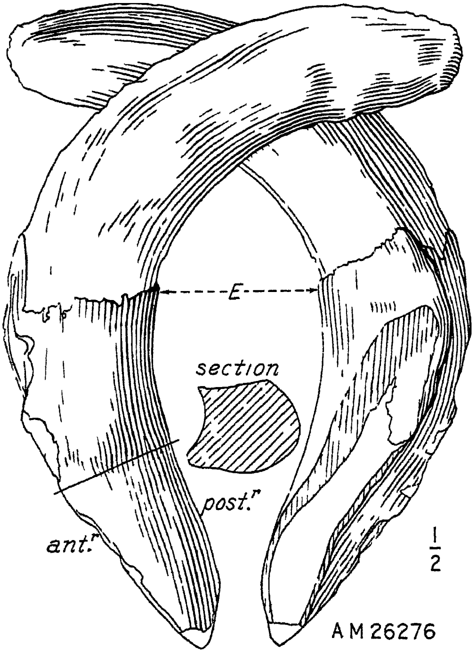

Fig. 7. *Eudinoceras kholobolchiensis* ref. Left superior canine tooth (Amer. Mus. 26276), external and internal aspects and section of mid-crown. This is possibly a male tooth belonging to the paratype male cranium (Amer. Mus. 21745) of larger size (compare Fig. 2B, and 6A).

DESCRIPTION BY WILLIAM DILLER MATTHEW

Field No. 544. Coryphodontid skull, found by Buckshot 7–8 m. south of camp on Kholobolchi Nor

General proportions of skull much like *Coryphodon* but exaggerated, and with a large maxillary boss above the canines. Not clear how far back nasals extend; the frontals may come up to form at least the back of this boss; the superior branch of premaxilla extends up to brace it on fronto-external face. Broad flattened top composed probably of frontals, parietals and supra-occipitals, but sutures not clearly distinguishable. Lachrymal tubercle prominent on margin of orbit which is small and very shallow, no definite postorbital processes on either frontal or jugal side. Jugal extends up in long superior branch forming a strong bridge anteroposteriorly from anterior end of zygoma. Canines very large, strongly flaring. The top is wider than in any known *Coryphodon*.

Teeth coryphodontid except that premolars have reduced internal crescent, molars shattered, but the last appears to be somewhat like *Metalophodon* [Cope], only more transversely oval.

Characters suggest a specialized descendant of *Coryphodon* intermediate between the American species and *Eudinoceras* in the premolar construction, but much nearer to the latter. If *Coryphodon* represents Lower Eocene stage and *Eudinoceras* early Upper Eocene, this might be late Middle Eocene. Note that *Metalophodon* is from the Black Buttes Lower Eocene, which appears to be a rather advanced form in its tendency to transverse crests on molars.

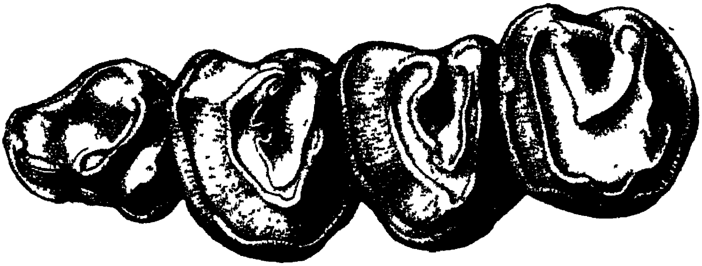

Fig. 8. Superior premolars, l.P^2-M^1, of *Dinoceras lucare* Marsh. Natural size. After Marsh (Monograph of the Dinocerata, 1884, Pl. ix). Compare figure 5.

Observe resemblance to premolars of *Eudinoceras* (Figs. 1 and 3).

Note that in [Field] No. 544 there is an apparent tendency to reduce the anterior wing of the premolars, leaving the posterior wing as a straight transverse crest. The whole evolutionary tendency in the dentition would seem to be towards tapiroid transverse cresting in molars and premolars. This same tendency is seen in some of the Irdin Manha [contains genotype *Eudinoceras mongoliensis* Osb.] and Shara Murun perissodactyls (*Depéretella*, etc.).

Remarkable fact that no trace of an amblypod foot bone has turned up in any of the Mongolian Eocene (except in the Gashato Paleocene).

[COMPARATIVE MEASUREMENTS IN MILLIMETERS
TYPE CRANIUM (AMER. MUS. 21744) AND DENTITION]

Length of skull, condyles to pmx inclusive			516
" " occiput to nasals			502
Breadth of skull, across zygomata (one side est'd)			380 [360]
" condyles			165 [159]
" across mastoid processes (ab't)			260
" " postglenoid processes			254
Length, postglenoid to condyles inclusive (ab't)			120
" dentition, incisive alveolus to M^3 incl.			284.5
" cheek teeth, P^1-M^3			177
" posterior nares to condyles			263
Breadth of palate across M^3			200
" palate in front of P^1			94
" across canine alveoli			200
Diam. of I^1 alveolus, anteropost.	15	Transverse	20
" I^2 " "	16.5	"	17
" I^3 " "	17.5	"	16.5e
" C^1 " "	36	"	47.5
" P^1 "	17.5	"	16.5
" P^2 "	22.5	"	32
" P^3 "	23.5	"	35
" P^4 "	22.3 [25]	"	38.5
" M^1 "	26.5	"	
" M^2 "	35	"	
" M^3 "	35	"	50.5

Fig. 9

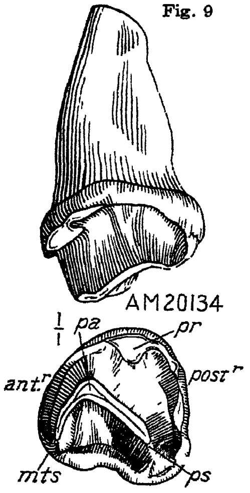

Fig. 10

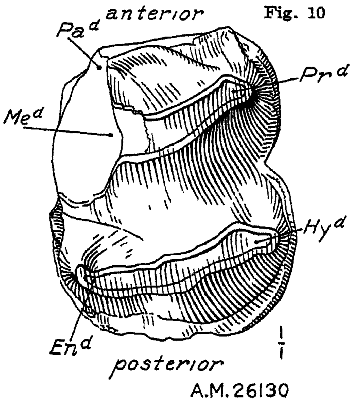

Fig. 9. *Eudinoceras mongoliensis* ref. First superior premolar of the right side, r.P^1. Natural size. Amer. Mus. 20134. For comparison with the corresponding premolar, r.P^1, of *Coryphodon testis* of the Lower Eocene, middle Wasatch levels of Wyoming. See figure 4.

Fig. 10. *Eudinoceras kholobolchiensis* ref. Second right inferior molar, r.M_2 (Amer. Mus. 26130). Observe that this tooth is similar to that of the r.M_3 of *Coryphodon testis* (Fig. 4).

Pa^d, paraconid; *pr^d*, protoconid; *me^d*, metaconid; *hy^d*, hypoconid; *en^d*, entoconid.

CONCLUSIONS

While concurring with the above cranial description by Matthew, the present authors await further material obtained in 1930 to determine whether or not the premolar evolution shown in these two species of *Eudinoceras* is, as Matthew implies, a retrogressive simplification and fore-and-aft compression of the Lower Eocene doubly crescentic premolar of *Coryphodon testis*, namely, by the degeneration of the internal protocone (*pr*) from the internal crescent observed in the Lower Eocene coryphodont premolars both of the Wasatch (Fig. 4) and Soissonnais (Fig. 11). In this more or less prominent internal crescent the *Coryphodon oweni* Hébert (after Hébert, 1857) agrees with all the species described by Cope from the American Wasatch.

The reverse interpretation is that this internal protocone (*pr*) is progressively increasing in size, as suggested by Osborn in his description of *Eudinoceras mongoliensis*. This suggestion will be put to the proof by the subsequent Oligocene stage of *Eudinoceras* discovered by us in 1930.

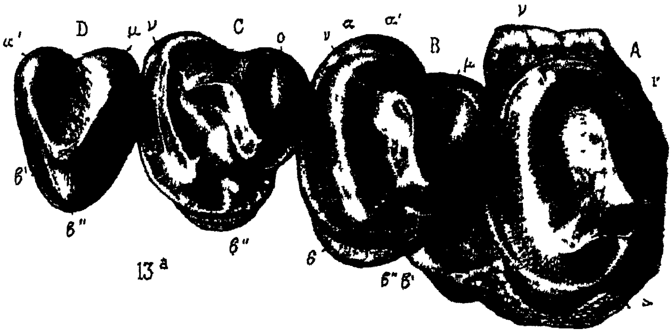

Fig. 11. Left superior grinders, P^4-M^3, of *Coryphodon oweni* Hébert, natural size, after Hébert, Ann. Sci. Nat., Ser. IV, Tome VI, 1856, Pl. III, fig. 13^a.

These Soissonnais molars are slightly more progressive than those of *Coryphodon testis* (Fig. 4) in the reduction of the median external cusp (*a'*), which is slightly stronger in *C. testis* (Fig. 4, *pa*). This evolution from the Soissonnais to the Wasatch form consists of the conversion of the metaloph into a simple transverse lophoid crest, by the loss of the distinctive foldings marked *pa, ms, me* in figure 4.

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PALÆOLOXODON ANTIQUUS ITALICUS SP. NOV., FINAL STAGE IN THE 'ELEPHAS ANTIQUUS' PHYLUM

BY HENRY FAIRFIELD OSBORN[1]

A flood of light on the anatomy and relationships of the 'ancient' or 'straight-tusked' elephant known as '*Elephas antiquus*' has resulted from the discovery in 1911–12 of the skeleton of Upnor and of the skull and jaws of Pignataro Interamna near Cassino, Italy, herein described as *Palæoloxodon antiquus italicus.* The skeleton of Upnor, under the subspecific name *Elephas antiquus* (*andrewsi?*), was excavated in 1915 and finally restored and reconstructed in the British Museum in 1927 under the direction of Dr. Charles W. Andrews and Mr. C. Forster Cooper.

The cranium and jaws of Pignataro Interamna were discovered in July, 1926, and exposed by a farmer, Saverio Tiseo, while excavating for building purposes, in the extraordinarily perfect condition shown in figure 1 and most fortunately reported to Professor Giuseppe De Lorenzo, Director of the Institute of Geology of the University of Naples and a member of the R. Accademia Nazionale dei Lincei. Professor De Lorenzo promptly made a preliminary communication[2] on this most important discovery, and in the following year (1927) published, with the coöperation of Professor Geremia D'Erasmo, also of the University of Naples, a superb memoir entitled "L'Elephas antiquus nell' Italia Meridionale."[3] This memoir (pp. 1–35) affords a most valuable review of the discoveries previously made in the valley of the river Liri (see Fig. 3) in the following localities:

Castelliri
Arpino
Fregellae
Ceprano
Casalvieri
Roccasecca
Cassino (grotto)
Aquino
Isoletta
Pontecorvo
PIGNATARO INTERAMNA
Caianello

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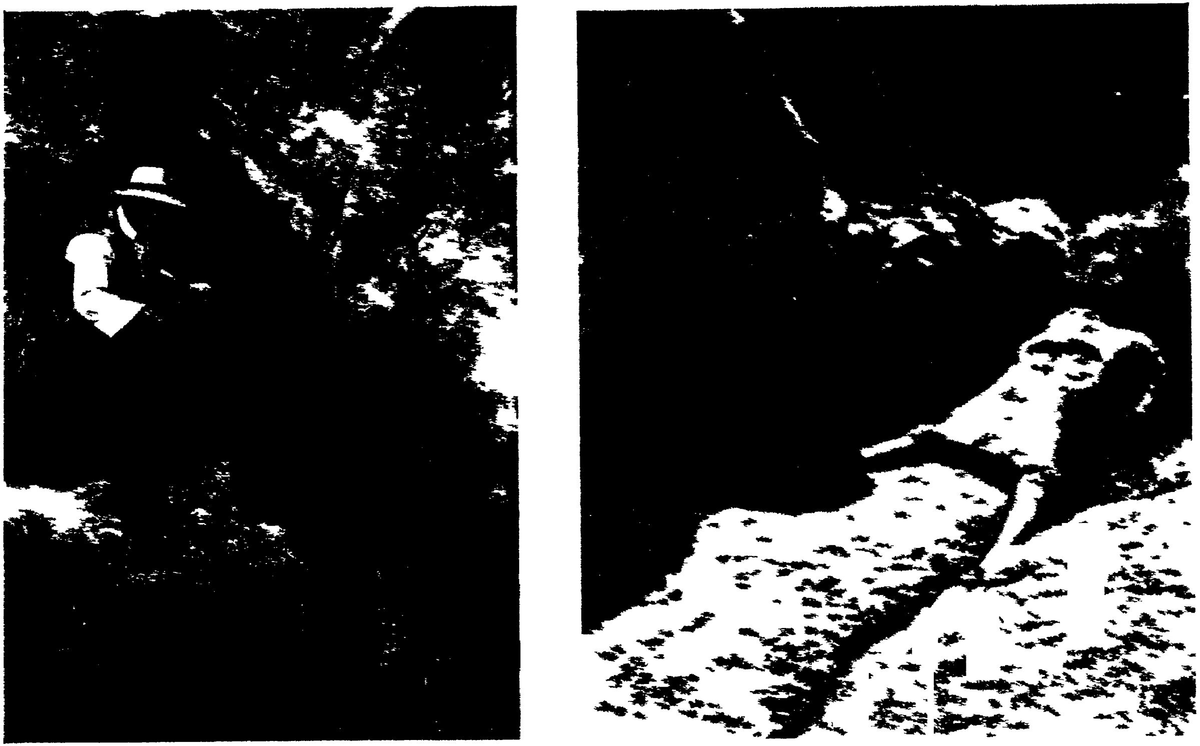
[1] This is the author's twenty-second communication on the evolution and classification of the Proboscidea since 1918, and the thirty-second in his total list of papers on the Proboscidea since 1907. See the author's chronologic and classified Bibliography to the end of the year 1929, namely, "Fifty-two Years of Research," pp. 3–54, 74–124.

[2] De Lorenzo, Giuseppe, 1926. "L'Elephas antiquus di Pignataro Interamna in Valle del Liri." Rend. R. Accad. Naz. dei Lincei, Classe di Sci., Fis., Matem. e Nat., Vol. IV, Ser. 6ª, 2° Sem., Fasc. 5–6. Rome.

[3] De Lorenzo, Giuseppe, and D'Erasmo, Geremia, 1927. "L'Elephas antiquus nell'Italia Meridionale." Mem. Atti R. Accad. Sci., Fis., e Matem. di Napoli, Vol. XVII, Ser. 2ª, N. 11.



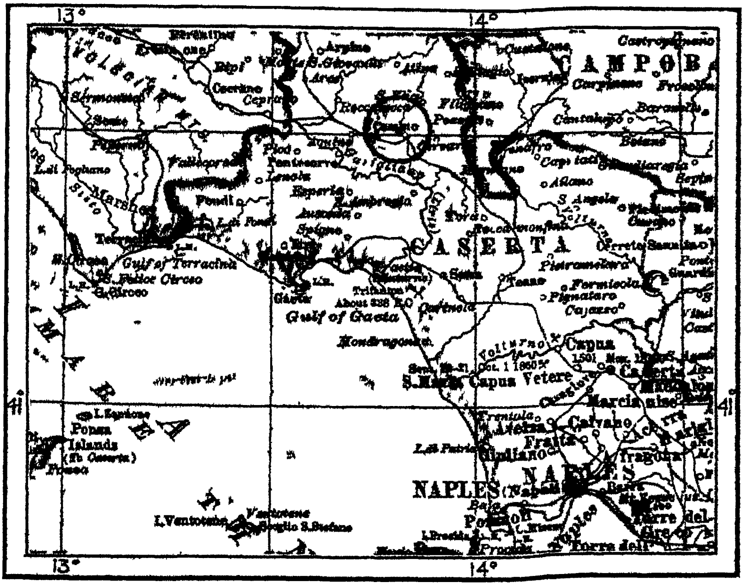
The Pignataro Interamna Cranium of Palæoloxodon antiquus italicus in the American Museum of Natural History (Amer Mus 22634)

Fig 1 Cranium *in situ* of *Palæoloxodon antiquus italicus* as found and exposed by Saverio Tiseo at Pignataro Interamna, near Cassino, Italy, and measured and described by Giuseppe De Lorenzo in 1926 and 927 Compare Tav I, figs 1 and 2, of the Memoir of 1927

ORIGINAL DISCOVERY AND DESCRIPTION

On pages 35 to 39 (see also Tav. I) of the De Lorenzo and D'Erasmo Memoir of 1927 is given a complete description of this superb cranium in its original state (as cited in full from De Lorenzo's original contribution of 1926, pp. 185–188), of which there is here presented a literal translation[1]:

> In the past month of July [1926], the farmer Saverio Tiseo, of Pignataro Interamna near Cassino, excavating, for building purposes, a piece of ground on his farm situated on the southern slope of the hill which borders the village and is really in Fontanarosa, found, at a depth of about 8 metres, a large cranium of a mammifer. This immediately became the object of great curiosity and talk, being announced in newspapers all over Italy as the fossil remains of a large Miocene mastodont.



Upper Middle Pleistocene Horizon of Pal. antiquus italicus
Compare figure 3 for details

Fig. 2. Pignataro Interamna is near Cassino (circle), southwestern Italy, about fifty miles north of Naples. Region of the Valley of the Liri (Liris) occupied in Pleistocene time by large herds of the 'ancient' or 'straight-tusked' elephant now known as *Palæoloxodon antiquus italicus*, also by *Hippopotamus*, *Cervus*, *Bos*, *Dicerorhinus*, and other species of *3d Interglacial* time. After Pl. 94 of the Century Atlas, edition of 1913.

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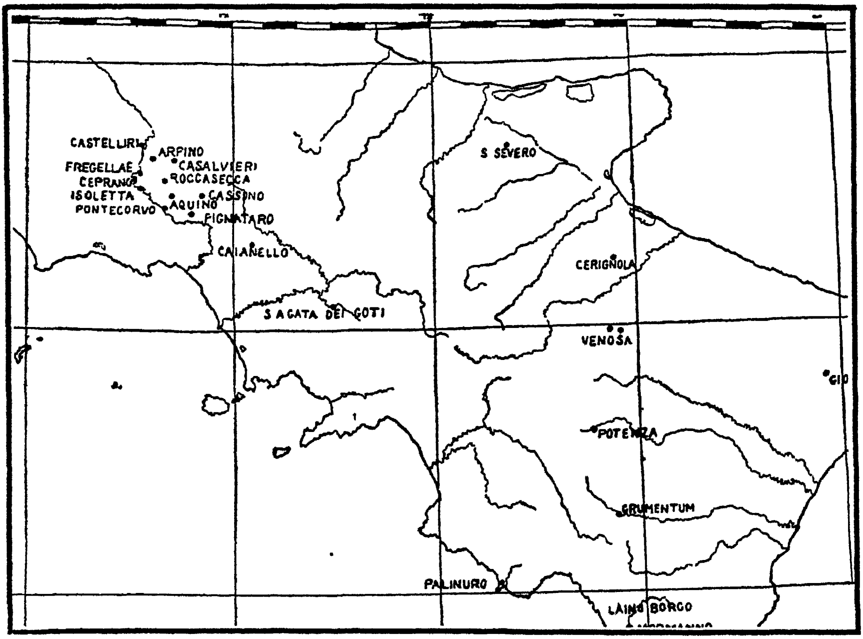
[1] Kindly prepared by Miss Francesca LaMonte of the Department of Ichthyology of The American Museum of Natural History.

The locality in which the fossil in question was found forms, with the hill of Pignataro Interamna, part of this whole system of gently rolling hills, which extend from Aquino and Pontecorvo along the left bank of the Liri as far as the river Rapido below Cassino, and which are made up of large alluvial deposits of the early quaternary, deposited first among the chain of the Aurunci and that of the Mainarde, later moulded by backwaters, defluents in lesser volume of the present and more confined course of the river Liri, which still today, as in the day of Orazio, continues with its calm waters the taciturn corrosion of its plains.

rura, quae Liris quieta
mordet aqua taciturnus amnis.

The present plains, formed in recent times by the Liri, extend below Pignataro Interamna to about twenty metres above sea level; while the hills mentioned above,



UPPER MIDDLE PLEISTOCENE HORIZON OF PAL. ANTIQUUS ITALICUS

Compare figure 2

Fig. 3. Valley of the Liri River displaying the principal exposures along the eastern and western banks and slopes of the bordering hills, varying from 60 to 70 meters above the present sea level, of a thickness of about 50 meters, where the remains of *Palæoloxodon antiquus italicus*, of *Hippopotamus*, of *Cervus*, and of other Pleistocene animals have been found. Twelve localities in which discoveries by Italian palæontologists of more or less perfect remains of this fauna have been recorded since the first note by Oronzio Costa in June, 1864. After De Lorenzo and D'Erasmo, 1927, p. 7, fig. 1. Upper portion only. Scale 1:3,000,000.

formed by the early quaternary diluvium, vary between 60 and 70 metres, thus giving a thickness of about 50 metres to the uncovered Pleistocene ground. This territory, prevalently clayish in the lower parts, becomes on top sandy,—yellowish sand and gravel interspersed with layers of clay and mud, and, on top, volcanic cinders.

In this early quaternary district some time ago there were already found remains of fossil mammifers, especially elephants. These have been preserved in part in the Museum of Geology and Palæontology of the University of Naples. Oronzio

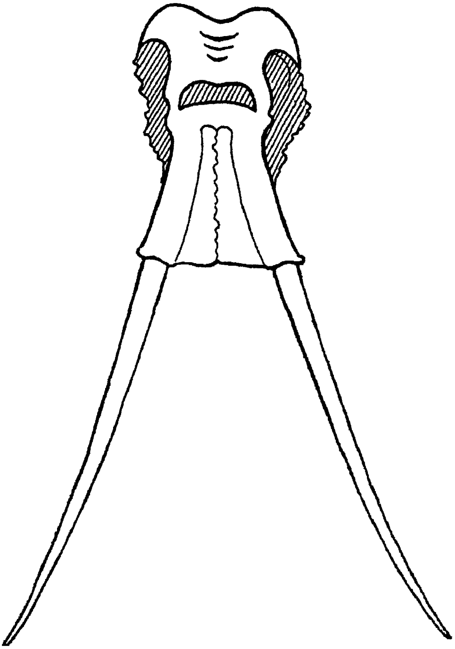


Fig. 4. Front view of the Pignataro Interamna cranium (Amer. Mus. 22634) *in situ*. After De Lorenzo and D'Erasmo, 1927, p. 36, fig. 10: "Cranio dell'*El. antiquus* di Pignataro Interamna, visto di fronte (1/40 della grand. nat.)." Reproduced same size.

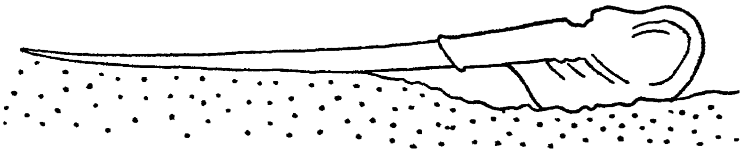


Fig. 5. Cranium of Pignataro Interamna (Amer. Mus. 22634) *in situ*. After De Lorenzo and D'Erasmo, 1927, p. 37, fig. 11: "Cranio dell'*El. antiquus* di Pignataro Interamna, visto di fianco, ancora parzialmente immerso nella sabbia (1/40 della grand. nat.)." Reproduced same size.

Costa first noted them in the Rendiconti della Reale Accademia di Scienze fis. e mat. di Napoli for June, 1864. They were fully described by Giustiniano Nicolucci in his memoir *Su gli elefanti fossili della Valle del Liri* [Concerning the fossil elephants of the Valle del Liri] (Memorie della Soc. ital. delle Scienze, detta dei XL, vol. IV, 1882). Cacciamali contributes further to this in the Bollettino della Società geologica italiana, 1890, describing some molars of the elephants of Val di Comino and of Aquino. Finally, they are mentioned by Antonio Weithofer in his memoir on the fossil Proboscideans of Valdarno (a memoir which serves as the descriptive matter for a geologic atlas of Italy, vol. IV, part 2, Firenze, 1893). Hans Pohlig also speaks of this in his big monograph on *Elephas antiquus*, published in the Nova Acta Academiae Caes. Leopold. Carol. Germanicae naturae curiosorum, vol. 53, Halle, 1889, and vol. 57, Halle, 1892.

My own and the observations of others are gathered together in my 'Geologia e Geografia fisica dell' Italia meridionale,' Bari (Laterza), 1904. On page 157 I spoke of the certain existence of *Elephas* (*Euelephas*) *antiquus* Falc. in the early quaternary deposits of the Valle del Liri.

The fact that remains of fossil elephants already existed in the Valle del Liri does not diminish the importance of the present discoveries at Pignataro Interamna; of really exceptional importance because of the completeness of the exhumed cranium and because of its position, a position which leads to the deduction that it was found in its original posture, not a secondary one caused by transportation, and this leads to the hope that it may be connected with the rest of the animal's skeleton.

The enormous head rests with its longitudinal axis, which measures not less than 3.50 metres from the frontal protuberance to the apex of the tusks, in an almost perfect horizontal position (Pl. I, figs. 1 and 2) in such a way as to lead one to suppose that the animal, descending to bathe in a muddy and richly vegetated brook, sank in the sand and mud, and, unable to swim, tried to keep its head and proboscis above in order to breathe as long as possible, until it sank altogether, and a lower alluvial deposit than that of its prey covered and surrounded the creature. This hypothesis is strengthened by the fact that in close proximity to the head and interspersed among the yellow gravel is a soft black layer, muddy and agreeing with the herbaceous vegetation of the bottom of the swamp in which the elephant probably sank. For these reasons it is anticipated that probably behind the head, still *in situ*, there is to be discovered all the skeleton of the elephant, which can therefore be dug out, given the opportunity.

But the excavation is not easy, not so much because of the depth as because of the easily shattered nature of the skeleton itself. The bones excavated up to now, that is, those of the head, as well as being petrified are, as it were, decalcified, in such a way that to isolate and gather them, there is need of great delicacy and accuracy. To isolate the mandible and uncover the molars, I myself had to dig a tunnel beneath the cranium, which I later filled in again to prevent slipping of the enormous skull. This decalcification and corrosion of the bones are due, I believe, to the fact that the water, penetrating from the humus into the subsoil loaded with carbonic acid, passed harmlessly through the sand which was prevalently silicious and gradually in the course of thousands of years, dissolved the phosphate and carbonate of the chalk of the skeleton, leaving the bones porous and blackened through the carbonization of the organic substance of the bony parts. The upper molars, for example, are reduced to a series of pockets devoid of enamel, all the dentine and cement having been carried

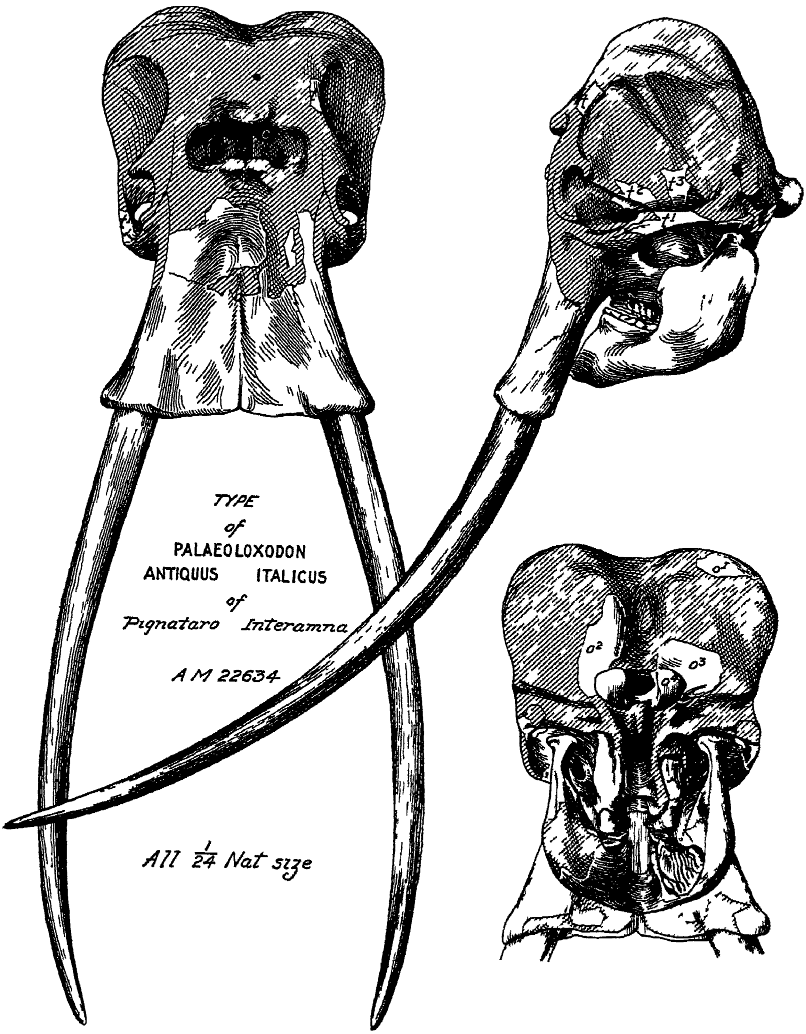


Fig. 6. Type cranium of *Palæoloxodon antiquus italicus* (Amer. Mus. 22634) as reconstructed and mounted in the American Museum during 1929 and 1930. One twenty-fourth natural size. Restored parts (oblique lines); parts preserved (shading), namely, occipital condyles, portions of premaxillaries and maxillaries, and complete mandible.

The measurements, as seen from the front, with but two exceptions accord exactly with those given above by De Lorenzo. The few original fragments seen in frontal aspect lie at the back of the narial chamber (*c*); along the border of the left temporal fossa (*t*), and along the temporal arch (t^1); in lateral aspect of the left side, as shown in the fragments in the left temporal fossa (t^2, t^3) just above the fragment of the right temporal arch (t^1), transferred to the left side for purposes of restoration. In posterior aspect, the occipital parts preserved are portion of the superior border (o^1), and parts of the posterior occipital plate (o^2, o^3) and the very broad condyles (or^4)

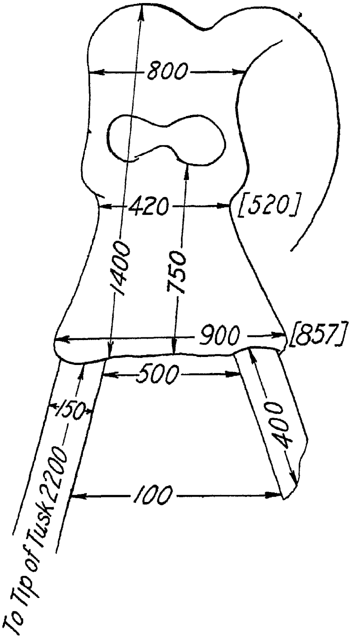


Fig. 7. Diagrammatic sketch, prepared in the American Museum to aid in the eighteen months' process of reconstruction. Cranium of *Palæoloxodon antiquus italicus* (Amer. Mus. 22634), based upon original photographs (Fig. 1), showing the exact measurements recorded in De Lorenzo's contribution of 1926 and fully quoted in his Memoir of 1927. The American Museum reconstruction, completed November, 1930, in front view accords exactly with the 1926–1927 measurements of De Lorenzo, except as to width of rostrum [857 mm., 520 mm.], as follows:

Apex of right tusk to vertex of cranium	3500 mm.	11 ft.	5¾ in.
Vertex of right tusk to border of premaxillary socket	2200	7	2⅝
Lower border of premaxillary socket to vertex of cranium	1400	4	7⅛
Diameter of incisive tusk at exit from socket	150		5⅞
Transverse breadth across premaxillary sockets	900 [857]	2	11⅜ [9¾]
Space between inner sides of incisive tusks.	500	1	7⅝
Transverse space across rostrum just below orbits	420 [520]	1	4½ [8½]
Midline of premaxillary rostrum to midline of nasal opening	750	2	5½
Transverse across narrowest portion of frontals	800	2	7½

away. This hypothesis is further supported by the fact that, while the sand and gravel above the fossil were loose and easily dug up, that below the head contained pieces harder than calcareous tufa, evidently the chalky deposits from the bones.

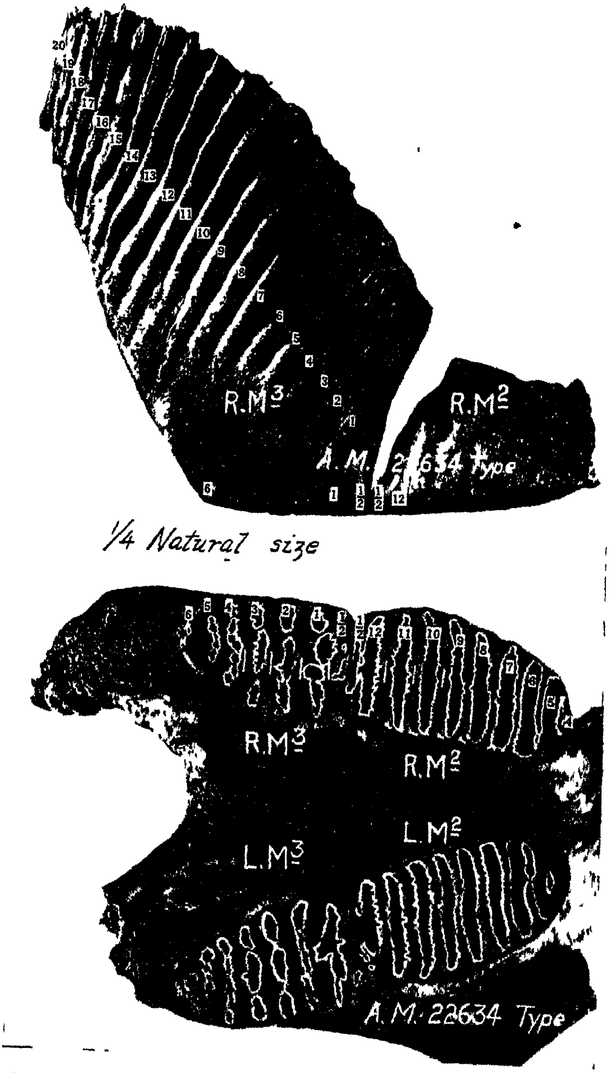
In this formation and in such conditions now lies the cranium of the elephant, truly imposing in its silent grandeur. From the peak of the cranial protuberance [vertex of cranium] to the distal border of the intermaxillaries it is 1.40 metres long, its width on the frontal line between the parietals is 0.80 metres. Characteristic is the fan-shape of the two intermaxillaries, which together, below the nasal cavity, measure 0.42 metres [520 mm.] wide, while on the anterior border, concave and circular, they widen to 0.90 m. [857 mm.], keeping in the free internal space between the two incisive tusks a width of 0.50 m. and having a total length, along the median suture, of 0.75 m. The two incisive tusks, 0.15 m. in diameter at the exit of the sockets and 2.20 m. long, very beautifully and perfectly formed and gently and elegantly curved both on the inner and outer curves, diverge widely, following the external line of the intermaxillaries in such a way that 0.45 m. from the exit of the sockets they are already a metre apart, and the two apices more than two metres from each other.

The mandible is so closely adherent to the upper maxillary that its symphysis appears to be almost soldered to the internal surface of the intermaxillaries. The symphysis is wide, near the condyles, about 0.60 m., with as much again in measurement on the bisettrice [midline ?]. On detaching the cranium, the plates of the upper molars, devoid, as we have said, of cement, and deprived of support, fell at once. The lower molars of the mandible stayed in place; especially on the right arc of the mandible one can see plainly the traces of the abrasion of the first (or second) molar, 0.10 m. long, 0.07 m. wide, with six residual plates, and the second (or third) molar, 0.17 m. long, 0.07 m. wide, with 10 plates.

All these characters, and especially the length of the cranium, the prominence of the protuberance and of the occipital fossa (see Pl. I, fig. 1), the enormous divergence of the intermaxillaries and of the incisive tusks (Pl. I, fig. 2 and interpolated figs. 10 and 11), the frontal depression, the narrowness of the plates of the molars in proportion to their height and to the length of the molars themselves, the form of the *difese* [framework?], show clearly that the cranium from Pignataro Interamna belongs to the species *Elephas* (*Euelephas*) *antiquus* Falconer, characteristic of the interglacial phases of the early quaternary and the largest of the few species of elephants which have inhabited the earth. The fortunate discovery of this complete cranium further shows that, contrary to what Pohlig wrote, Falconer was right in maintaining that his *Elephas antiquus* was closely allied to the living Indian elephant, *Euelephas indicus*.

If the excavations are continued, as it is to be hoped they will be, one will be able later on to issue a more exact and complete description of the magnificent animal of Pignataro Interamna.

The above citation from G. De Lorenzo and G. D'Erasmo (1927), pages 35–39, figures 10 and 11, and plate I, figures 1 and 2, affords invaluable information as to the Pignataro Interamna cranium in its original undisturbed condition partly buried in the matrix. These drawings and photographs demonstrate the superb condition of the cranium and tusks when first exposed and our knowledge is fortunately amplified by two photographs (reproduced in our Fig. 1) subsequently taken by



1/4 Natural size

Fig. 8. Type superior grinders of *Pal. antiquus italicus* (Amer. Mus. 22634). One-fourth natural size. After original photographs, retouched and numbered, displaying ridge-plates 1 to 20 in r.M^3, ridge-plates 4 to 12 in r.M^2.

(Upper) Second and third right superior molars, r.M^2, r.M^3.

(Lower) Palate exhibiting right and left superior molars, M^2, M^3.

Saverio Tiseo before he attempted to remove this priceless fossil from its original bed in the matrix. The precise knowledge of the specimen in its original condition afforded by these four photographs, also by the measurements and outline sketches by De Lorenzo reproduced in our figures 4 and 5, is in close accord with the measurements in De Lorenzo's original paper of 1926, pages 187 and 188, as reproduced in our diagram (Fig. 7). Had it not been for these priceless measurements, sketches, and figures, we should find ourselves obliged to record one of the most tragic losses in the history of vertebrate palæontology, namely, the characters of the cranium, jaws, and tusks of an adult *Elephas antiquus* in a perfect condition of preservation.

In the hope that the excavations would be continued and the precious remains would become a part of the collection of the State, Professor De Lorenzo, as Director of the Institute of Geology of the University of Naples, made every effort (1927, p. 39) to secure the specimen for the Naples Museum, but without success.

ACQUISITION BY THE AMERICAN MUSEUM

During the following year (September 4, 1928), the Director of The American Museum of Natural History was informed of the desire of Saverio Tiseo to dispose of the specimen and began negotiations (November, 1928) on condition that no step would be taken without due permission from the authorities of the Italian Government. On December 3, 1928, these terms were formulated in detail, and in May, 1929, the specimen was received in the American Museum.

On opening the boxes containing the fossil, the extremely painful discovery was made that between 1927, when the negotiations of Tiseo with De Lorenzo were concluded, and 1929, the owner Saverio Tiseo had irretrievably damaged the entire upper portion of the cranium by attempting to remove it for purposes of exhibition. Thus the superb and unique cranium shown in Professor De Lorenzo's description and in the figures and photographs above mentioned and reproduced in the present text no longer existed. The remaining parts of the specimen, namely, the rostrum, tusks, palate, jaws, and the lower portion of the occiput were also seriously damaged, while the entire upper portion was irrevocably lost to science with the exception of three small pieces extricated with great difficulty from the hard cement in which Tiseo had attempted to repair the terrible injury which he had inflicted on this priceless specimen. At first the reconstruction of the skull appeared hopeless, and the present author, who had donated it to the American Museum collection on the basis of the excellent photographs showing the specimen in its original condition, was not even allowed to see it in the laboratory. After eighteen months of arduous labor on the part of Mr. Jeremiah Walsh, under the direction of Mr. Charles Lang, chief preparator, and of Curator Barnum Brown, and finally of Honorary Curator-in-Chief Osborn, the reconstruction entered its final stages in which the precise measurements, figures, and photographs secured by Professor De Lorenzo of the cranium in its original unfractured condition were of incalculable value and importance. Thus, after almost continuous and very expensive labor between May, 1929, and November, 1930, the specimen was ready for complete description and exhibition, although not open to the public until January 1, 1931.

The total cost to the American Museum, including the donation of $1,000.00 by President Osborn, originally estimated at $500.00, mounted step by step to $4,375.34, almost nine times the amount originally set aside for the purpose.

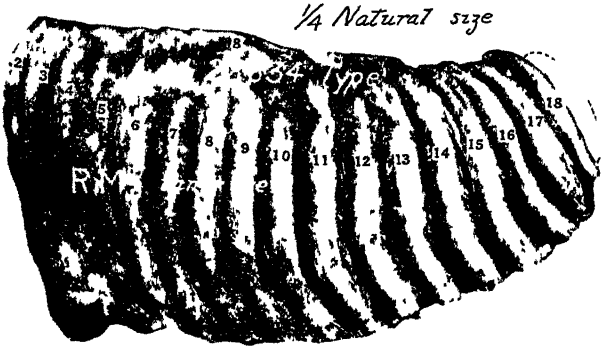


Fig. 9. Type of *Pal. antiquus italicus* (Amer. Mus. 22634). Inner view of third right inferior molar, r.M_3, exhibiting +18+ ridge-plates. One-fourth natural size.

Despite all these financial drawbacks and scientific disappointments, the restored cranium and tusks, jaws, and scapula still afford a wealth of new knowledge regarding the relationships of the classic *Elephas antiquus*, which, added to the equally priceless Upnor skeleton, remove this great branch of the family Elephantidæ from its previous obscurity and uncertainty and enable us to rank it next to *Elephas primigenius* as the best known of the fossil elephants of Eurasia.

Whereas *Palæoloxodon antiquus* belongs in the Lower Pleistocene, or *1st Interglacial,* the present specimen belongs in the upper Middle Pleistocene, or *3d Interglacial,* it is somewhat more progressive than the *Pal. ant. germanicus* of Weimar.

Palæoloxodon antiquus italicus is far superior in size to *Pal. namadicus* and greatly surpasses *Pal. antiquus typicus* both in the number and height of the ridge-plates as well as in the length of the crown. It is a very

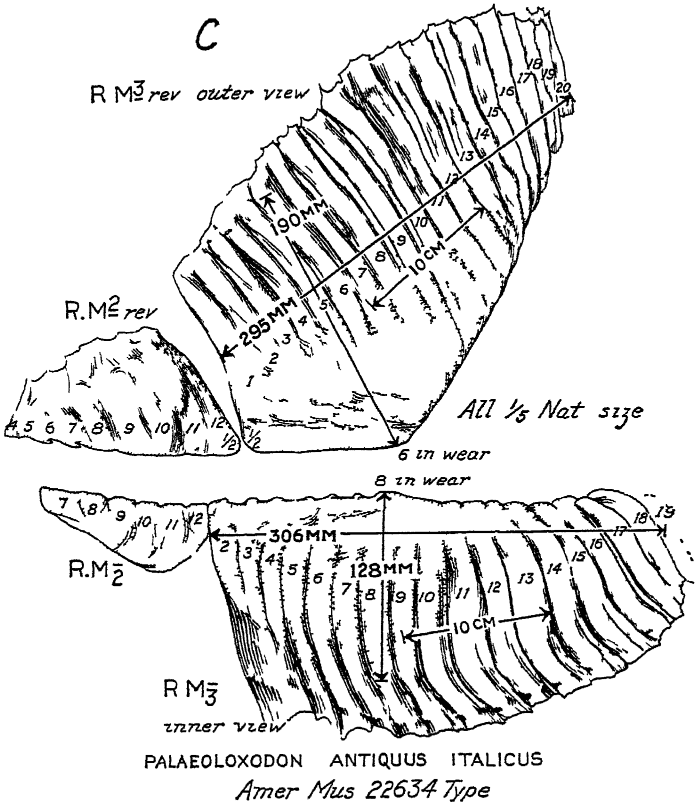
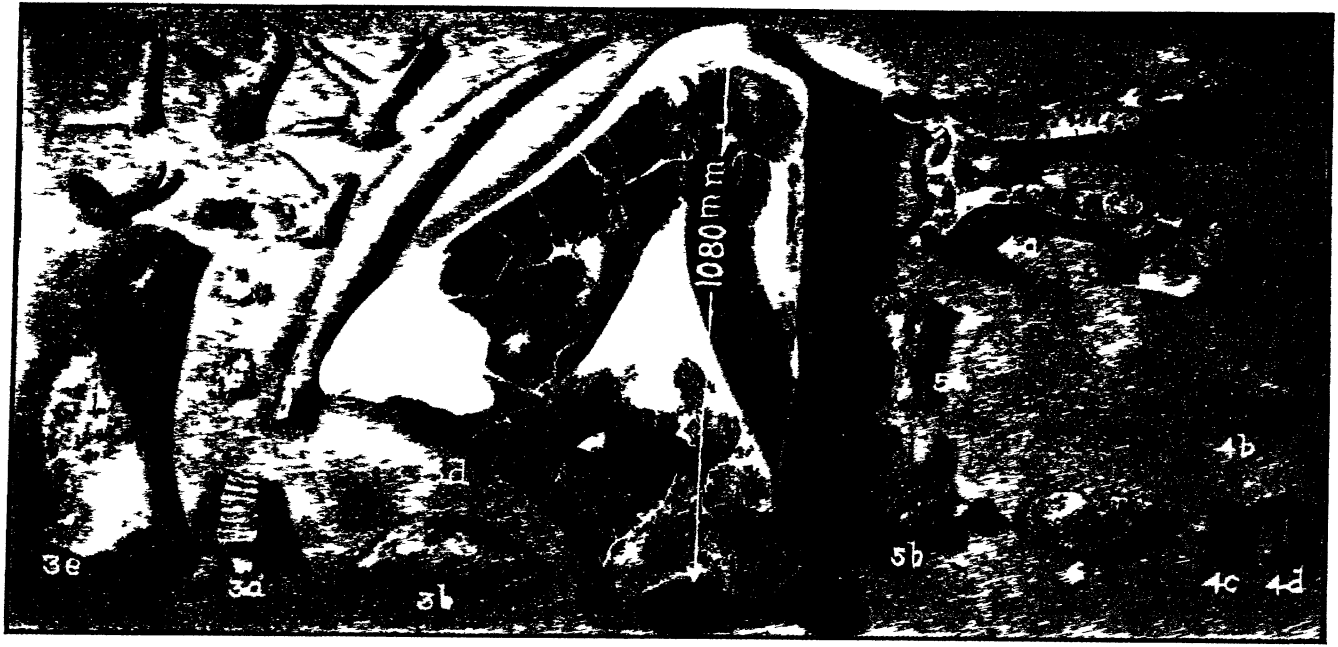


Fig 10 Type right superior and inferior grinders, M 2, M 3, of *Pal antiquus italicus* (Amer Mus 22634) Diagrammatic key to the superior and inferior ridge-plates·

$$M\ 2\ \frac{12\frac{1}{2}}{12} \qquad M\ 3\ \frac{20}{18+}$$

The principal measurements of r M^3 are Length of 20 ridge-plates 295 mm.; height of 5th ridge-plate 190 mm ; 6 ridge-plates in 10 cm The principal measurements of r M_3 are: Length 306 mm , height of 8th ridge-plate 128 mm , 4 ridge-plates in 10 cm



Associat Mammalian Fossils

About one-thirteenth natural size

Fig 11 Type righ capula (3*d*) of *Palæoloxodon antiquus italicus*

(3*a*, *b*, *c*, *e*) Fragment of right second inferior molar (r M_2), symphysis of mandible, nearly complete femal usk, and central portion of right humerus of *Pal ant italicus* (*d*) right scapula (probably belonging to type)

(4*a*, *b*, *c d*) Mandib 5th cervical, Mts IV, juvenile femur of *Hippopotamus amphibius maior* ref

(5*a*, *b*) Right radius d 7th cervical of *Rhinoceros merchi* ref

(2*a*, *b*) Portion of l t inferior molar (M_1) and fragm t of mandible of *Bos primigenius*

(1*a*, *b*, *c*) Portions of ree antlers from the left side, two tlers from the right side, also right astragalus of the s g *Cervus elaphus* progressive ascending mutation, equaling in size, but exceeding in the number of its superior ridge-plates, the most progressive *Pal. ant. germanicus* of Weimar. However, from close comparison with all the numerous specimens described from Lower Pleistocene deposits in England (by Falconer and others) to *3d Interglacial* deposits in Weimar (by Pohlig and Soergel), *Pal. ant. italicus* appears to be the largest and most progressive member of the '*Elephas antiquus*' phylum thus far discovered.

Fortunately the second and third superior and inferior molars of both sides were preserved *in situ* and their characters are very clearly displayed in the accompanying type figures, in which all the ridge-plates are shown both in crown and lateral view, with clear enumeration of the ridge-plate numbers in figures 8 and 9 and in the diagrammatic figure 10. Very important is figure 8 (lower) in which 15 ridge-plates are shown in simultaneous use, namely, r.M^2, ridge-plates 4 to 12½, plus r.M^3, ridge-plates ½-1 to 6. This stage of attrition represents a young adult male, corresponding with the attrition of *Elephas indicus* estimated to be about forty years of age. To the 20 ridge-plates actually observed in r.M^3 (Fig. 8) there may doubtless be added ridge-plates 21 and 22; whereas in a much older individual of *Pal. ant. typicus* only 16½-17 ridge-plates are shown.

According to recent estimates of Pleistocene time, a 500,000-year interval elapsed between the typical Lower Pleistocene '*Elephas antiquus*' Falconer and the new subspecies herein described, which is even somewhat more progressive than the '*Elephas germanicus*' Pohlig of Taubach-Weimar.

GEOLOGIC AGE.—The more or less fragmentary mammalian remains found in proximity to the *type* include the following (see Fig. 11):

(1) *Cervus elaphus* Linn.: (a) Three antlers from the left side, (b) two antlers from the right side, and (c) right astragalus. Stag.

(2) *Bos primigenius* Boj.: (a) Portion of left M_1 and (b) fragment of the mandible. Primitive ox.

(3) *Palæoloxodon antiquus italicus* sp. nov.: (a) Fragment of r.M_2, (b) symphysis of mandible, (c) a nearly complete female tusk, (d) right scapula (probably belonging to the *type*), and (e) central portion of a right humerus. Ancient elephant.

(4) *Hippopotamus amphibius* Linn. (Pleist. =*H. major* Cuvier): (a) Complete mandible (Fig. 17), (b) cervical 5, (c) left metatarsal IV, and (d) left femur (juvenile). African hippopotamus

(5) *Rhinoceros merckii* Kaup: (a) Right radius and (b) cervical 7. Merck's rhinoceros.

(6) Associated with the mammal fauna was the imperfect shell of a freshwater mollusc, referable to the genus *Unio*, of the family Unionidæ.

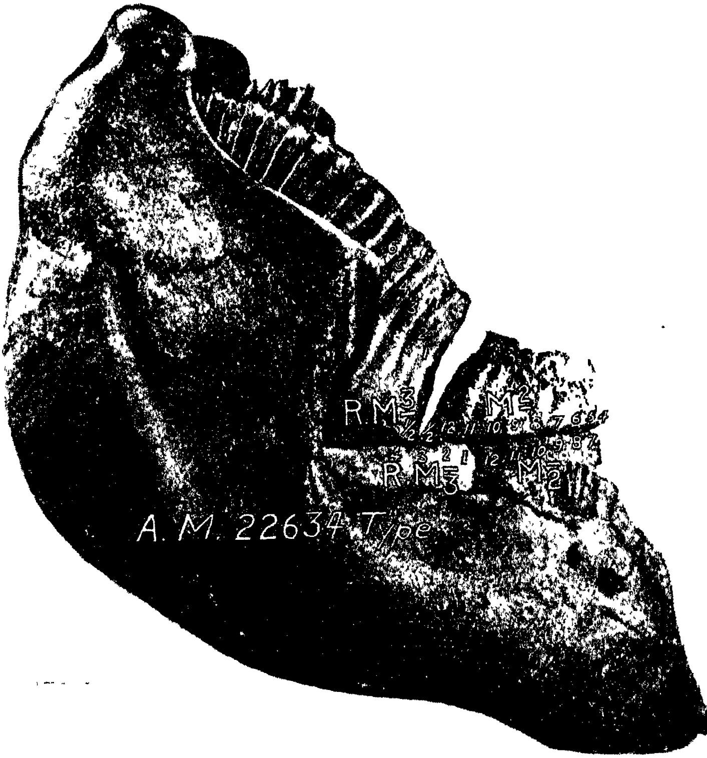


Fig. 12. Type inferior mandible of *Pal. antiquus italicus* (Amer. Mus. 22634). One-sixth natural size. After original photographs, retouched and numbered, showing the ridge-plates so far as exposed to view.

Right lateral view of type jaw with second and third superior teeth, M^2, M^3, superposed on corresponding inferior teeth, M_2, M_3.

Palæoloxodon antiquus italicus, sp. nov.

TYPE.—Amer. Mus. 22634. Cranium and jaws with superior and inferior dentition (M 2–M 3) of a young adult male; also right scapula.

LOCALITY AND HORIZON.—Found in upper Middle Pleistocene river gravels, of *3d Interglacial* time, equivalent to, or slightly more recent in geologic age than, the *3d Interglacial* stage of Taubach-Weimar of the Ilm River valley, Saxe-Weimar, Thuringia, northern Germany, 40 kilometers east and a little south of Burgtonna, north of Gotha, where the first skeleton of '*Elephas antiquus*' (described by Blumenbach as *Elephas primigenius*) was discovered in 1695 (see Chap. XIX of forthcoming Proboscidea Memoir).

SUBSPECIFIC CHARACTERS.—Displayed in the measurements, ridge-plate formulæ, and height of the ridge-plates, enumerated below; also illustrated in the type figures 8, 9, 10, and 12 of the present publication. Progressive evolution indicated as follows:

Pal. ant. typicus; M 3 $\frac{16\pm}{17}$. M^3, length 254 mm., height of tallest ridge-plate 174 mm.; M_3, length 315 mm., height of tallest ridge-plate 126 mm.

Pal. ant. germanicus; M 3 $\frac{17+}{18+}$. M^3, length 295 mm., height of tallest ridge-plate 190 mm.; M_3, length 425 mm., height of tallest ridge-plate 120 mm.

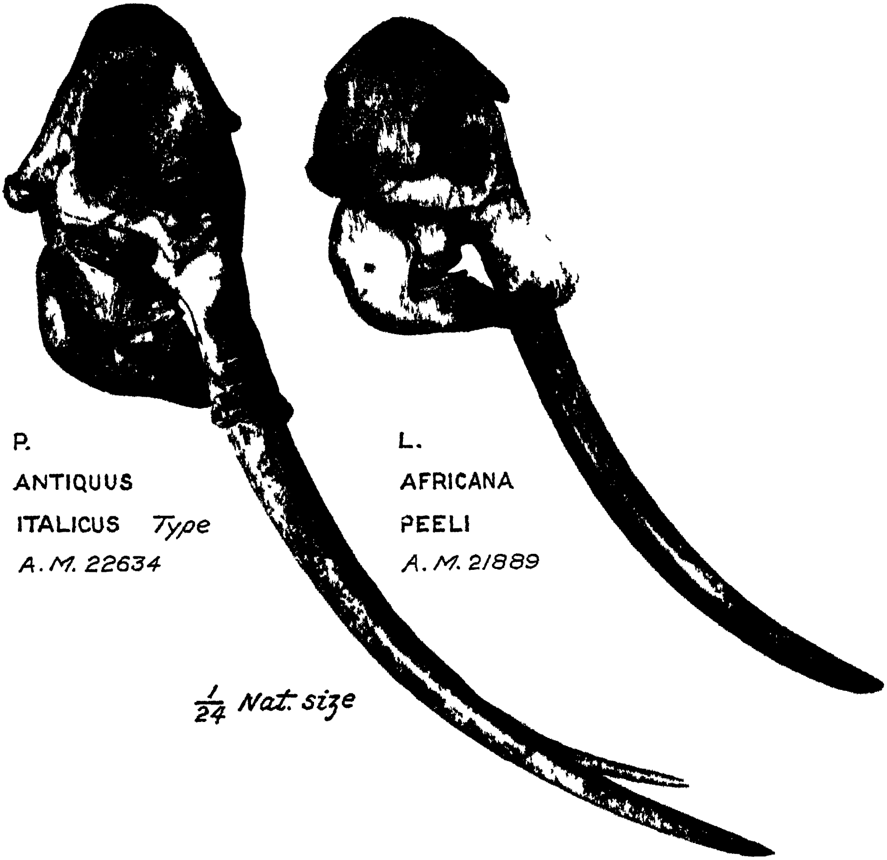
Pal. ant. italicus (type): M3 $\frac{20}{18+}$. M^3, length 295 mm., height of tallest ridge-plate 190 mm.; M_3, length 306 mm., height of tallest ridge-plate 128 mm.

INCISIVE TUSKS.—The incisive tusks of the type are not fully grown (see Figs. 4, 5, 6, 13, 14). Total estimated length 3030–3070 mm., that is, 800e mm. within the alveolus plus 2230–2270 mm. beyond the alveolar border. The longest tusk recorded by Pohlig in the University of Rome collection measures 3900 mm., or 12 ft. 9½ in., in comparison with 10 ft., length of the present specimen. This indicates that a full-grown adult male of *Pal. ant. italicus* attained gigantic size.

LOWER JAWS (FIGS. 6, 12).—The type inferior mandible is entirely complete, as represented in figure 12, requiring little or no restoration. As compared with the more or less complete mandibles figured by Falconer, from the Lower Pleistocene of England, it closely resembles in profile aspect the typical '*Elephas antiquus*' jaw but is very much larger and more massive; it differs widely in every aspect from the mandibles belonging to any species of *Archidiskodon*, *Parelephas*, or *Mammonteus;* the rostrum is abruptly truncated but less abbreviate than in '*Elephas primigenius*,' which is more of the extreme bathycephalic type.

SKULL.—The extremely broad rostrum, characteristic of all stages of the '*Elephas antiquus*' phylum, measuring 857 mm. or 2 ft. 9¾ in., is exactly the same width as that of the '*Elephas platyrhynchus*' of Graells, which measures 860e mm. or about 2 ft. 10 in. transversely; this animal is from the Pleistocene, at San Isidro, near Madrid, Spain.

Most novel and surprising is the dome-like, highly arched occipito-parieto-frontal contour (Figs. 4, 5, 6, 13, 14) which superficially resembles that of the Indian elephant more closely than that of either *Loxodonta africana* or *Palæoloxodon namadicus.* This lofty profile and corresponding bathycephaly are represented correctly in figures 6 and 13, because they accord exactly with the measurements and photographs taken by De Lorenzo and Saverio Tiseo before this cranium was damaged. Moreover, beside the well preserved and extraordinarily broad occipital condyles (280 mm.), there are portions of the occiput (Fig. 6, o^1, o^2, o^3, o^4) which prove that the occiput is forwardly inclined. The chief comparative measurements between this restored cranium and the cranium of the adult African bull elephant (*Loxodonta africana peeli*—see Fig. 13) are as follows:



Crania of Palæoloxodon and Loxodonta in Lateral View

Photographs reduced to uniform one twenty-fourth scale. Compare figures 6, 14

Fig. 13. (Left) Cranium and tusks of *Palæoloxodon antiquus italicus*, right lateral aspect. Amer. Mus. 22634.

(Right) Cranium of *Loxodonta africana peeli*, adult male, from Mt. Kenia district (Amer. Mus. 21889). See Chapter XIX of forthcoming Proboscidea Memoir.

COMPARISON WITH AFRICAN ELEPHANT	*Loxodonta africana peeli*			*Palæoloxodon antiquus italicus*
(1) From front of orbit to back of occipital condyle	746 mm.		+10%	=820e mm.
(2) From summit of parieto-occipital crest to attritional surface of M^3 (bathycephaly)	800		+24%	=990e
(3) Occipital condyles, transverse	248		+13%	=280
(4) Temporal arches, transverse width across	797		— 6%	=750e
(5) Premaxillary rostrum, maximum width across	665		+29%	=857
(6) Mandibular condyle, height above angle of jaw	489		— 2%	=478
(7) Mandibular length, condyle to apex of rostrum	749		+ 7%	=800
(8) Incisive tusks:	L	R	L	R
total length of	1960e	2010e	3030e	3070e
free length beyond rostrum	1905	1960	2230	2270
maximum diameter at exit from rostrum	156	160	145	139
total circumference of	460	467	433	432

COMPARISON WITH L. AF. PEELI.—In (4) width across temporal arches, *L. africana* exceeds *Pal. ant. italicus* by six per cent. In percentages the cranium of *Pal. ant. italicus* in all other measurements is from seven to twenty nine per-cent. larger than that of *L. africana*, as follows:

(1) Orbit to occipital condyles	10%
(2) Cranial apex to grinding surafce of M^3	24%
(3) Transverse occipital condyles	13%
(5) Width across premaxillary rostrum	29%
(7) Mandibular length	7%

On the average of the five principal measurements, the cranium of *Pal. ant. italicus* is about fifteen per cent. larger than that of *L. africana.* If this fifteen per cent. increase obtains throughout the entire skeleton, the skeletal height of *Pal. ant. italicus* should be about 3673 mm. or 12 ft., as compared with the height *in the flesh* of a large adult bull of *L. africana*, namely, 3450 mm. or 11 ft. 4 in., or with the skeletal height of the *Palæoloxodon antiquus* (*andrewsi?*) of Upnor, from the top of the scapula to the ground, namely, 3700 mm. or 12 ft. 1⅝ in.; thus it appears from the cranial proportions only that the skeleton of *Pal. ant. italicus* was about fifteen per cent. taller at the shoulder than that of the African elephant and closely similar in height to that of the Upnor elephant.

COMPARISON WITH PAL. NAMADICUS.—Examined closely, the above measurements prove that the cranium of *Pal. ant. italicus* is profoundly different from that of '*E. namadicus*' (the genotypic species[1] of *Palæoloxodon*) as well as from that of *Loxo-*

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[1] Described by Matsumoto (1924) under the subspecific name *Palæoloxodon namadicus naumanni.*

donta africana, which is a relatively primitive cranium. Coördinated with its very tall grinding teeth, the cranium of the Italian specimen is much more bathycephalic (depth 990e mm. as compared with 800 mm. in *L. africana*); it is correspondingly less brachycephalic (750e mm. as compared with 797 mm.); this is in accord with the cranial proportions which are much nearer those of the Indian elephant than of the African elephant. This bathycephaly is, however, a parallelism rather than a point of affinity, because the very broad rostrum of *Pal. ant. italicus* presents an extreme differ-

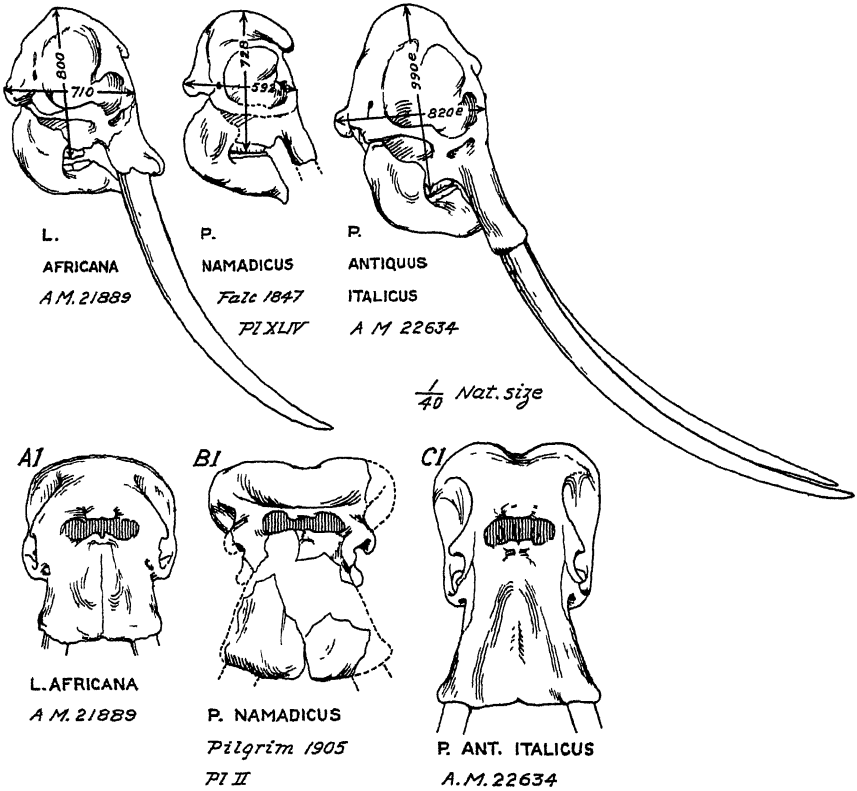


Fig. 14. Comparative front and side views of three adult males. One-fortieth natural size.

A, A1, *Loxodonta africana*. Original.

B, B1, *Palæoloxodon namadicus*. After Falconer and Pilgrim.

C, C1, *Palæoloxodon antiquus italicus*. Original.

Observe as to *bathycephaly* that *P. namadicus* (592 : 728 mm.) about equals *L. africana* (710 : 800 mm.), while *Pal. ant. italicus* is much more bathycephalic (820e : 990e mm.).

ence from the very narrow rostrum of *Elephas indicus*. Comparison with the cranium of '*Elephas namadicus*' shows a strong resemblance in the breadth of the premaxillary rostrum but an extreme difference in the summit of the cranium, which in '*E. namadicus*' is relatively low and reinforced by the overhanging parieto-frontal crest.

This points to *Pal. ant. italicus* as a member of a phylum quite distinct from that of the Siwalik '*E. namadicus*,' a phylum which if supported by other cranial and skeletal differences might well constitute a new genus to which the name HESPEROLOXODON, or 'loxodont of the west,' might be applied. This name is provisionally proposed, as I would not like to be forestalled a second time, as in the case of *Palæoloxodon*, a generic name assigned to '*E. namadicus naumanni*' by Matsumoto but a few weeks prior to my description of *Sivalikia*.

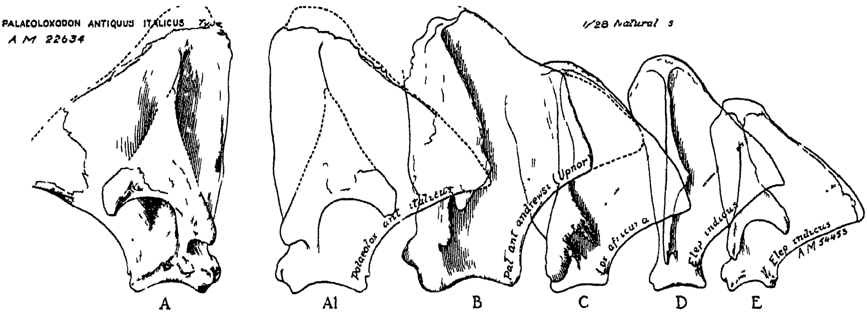
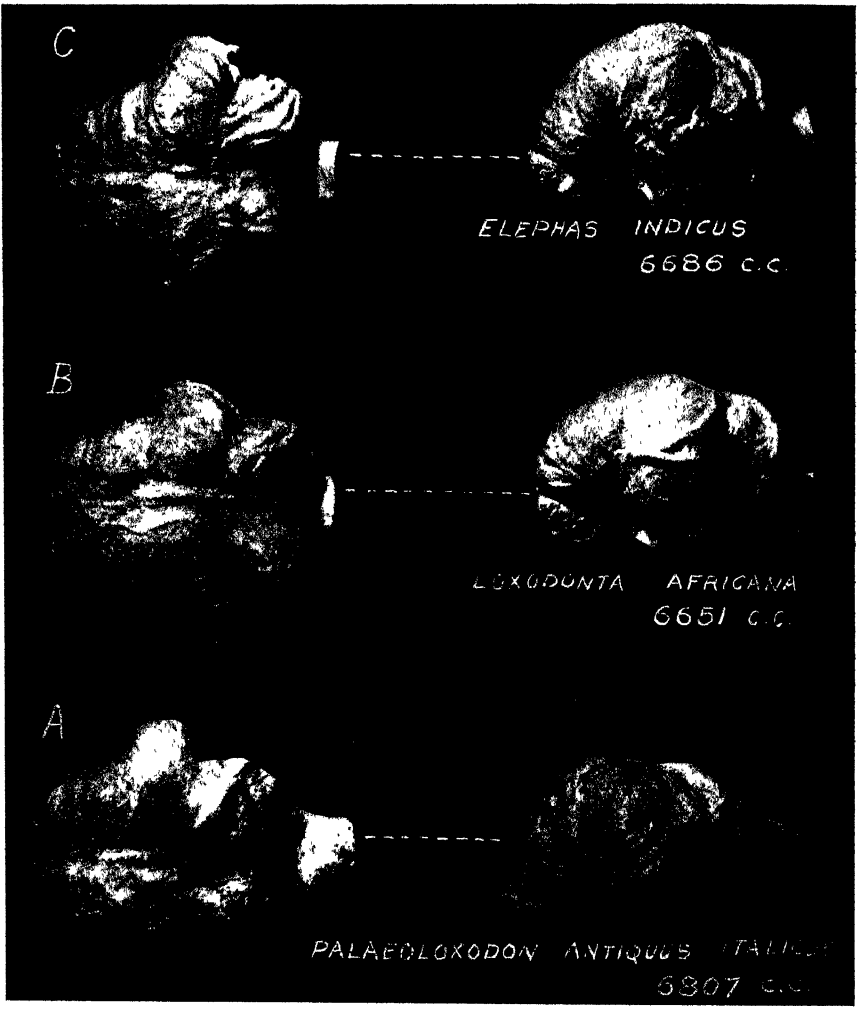


Fig. 15. Right scapula (A, A1 in reversed outline) of the type of *Pal. ant. italicus* (Amer. Mus. 22634) drawn to the same scale as the corresponding scapula of (B) *Pal. ant.* (*andrewsi?*), of (C) *Lox. africana* and of (D) *Elephas indicus*, juvenile (both after Andrews and Cooper, 1928, fig. 2), also of (E) *Elephas indicus*, adult (Amer. Mus. 54453), Vernay's middle-aged male, of which the entire fore limb is shown in Osborn's forthcoming monograph. All figures one twenty-eighth natural size.

SCAPULA.—The right scapula (Fig. 15A, A1) was found near the type and may be considered as belonging to the same individual (Amer. Mus. 22634); it greatly exceeds in size that of the African and Indian elephants of the same age (Fig. 15 C, D, E). On the other hand, it is slightly exceeded in size by the left scapula (Fig. 15B) preserved in the Upnor skeleton. The measurements of the scapulæ of *Pal. ant. italicus* and *Pal. ant.* (*andrewsi?*) are taken with the restored border indicated in dotted lines:

SCAPULA	*Lox. africana oxyotis* (Jumbo)	*Pal. ant. italicus* Pignataro		*Pal. ant.* (*andrewsi?*) Upnor	
Height, superior border (restored) to center of glenoid border	925 mm.	+15%	= 1065 mm.	+10%	= 1170 mm.
Width, median, across pre- and post-scapular borders	594	+29%	= 770	+12%	= 868e
Anteroposterior diameter of neck of scapula	240	+28%	= 307	+ 6%	= 324
Anteroposterior diameter of glenoid border	187	+35%	= 253	+15%	= 290



Intracranial Casts of Palæoloxodon, Loxodonta, and Elephas

Fig. 16. Intracranial cast of the Pignataro Interamna specimen compared with casts of the African elephant and the Indian elephant, as exhibited in the American Museum.

	Brain Cube c.c
C) *Elephas indicus*	6686
B) *Loxodonta africana*	6651
A) *Palæoloxodon antiquus italicus* (Amer. Mus. 22634)	6807

ESTIMATES OF SKELETAL AND FLESH HEIGHT.—It is important to compare the estimates of the shoulder height derivable from the scapula as well as from the cranium; they are found to agree exactly, as shown below. Neither the Upnor nor the Italian specimen is full-grown, yet combined they afford a priceless means of estimating the height of the full-grown '*Elephas antiquus.*'

In each of the four above dimensions the scapula of *Pal. ant. italicus* is from fifteen to thirty-five per cent. larger than that of *Lox. africana oxyotis* ("Jumbo," Amer. Mus. Dept. Mam. 3283); the actual skeletal height of "Jumbo" is 10 ft. 5¾ in. or 3194 mm.; consequently if we add fifteen per cent. (the difference in scapular height) to the skeletal height of "Jumbo" we obtain 3673 mm. or 12 ft. ⅝ in. as the estimated skeletal height of the *Pal. ant. italicus* type; this agrees with the height estimated from the proportions of the cranium, namely, about 3673 mm. or 12 ft. ⅝ in.

In height the scapula of *Pal. ant. italicus* is about ten per cent. less than that of *Pal. ant.* (*andrewsi?*) of Upnor, the skeletal height of which is 3700 mm. or 12 ft. 1⅝ in.

Pal. ant. italicus;	
Total skeletal height *estimated* from proportions of cranium	3673 mm. = 12 ft. ⅝ in. ca.
Total skeletal height *estimated* from proportions of scapula	3673 mm. = 12 ft. ⅝ in. ca.
Pal. ant. (*andrewsi?*)	
Total skeletal height *estimated* from proportions of entire fore limb	3700 mm. = 12 ft. 1⅝ in.

To this estimated skeletal height should be added about six and one-third per cent. to obtain the height in the flesh, giving us an estimated height at the shoulder of 3905 mm. or 12 ft. 9¾ in.

Pal. ant. italicus of Pignataro Interamna, adult:	
Estimated height in the flesh	3905 mm. = 12 ft. 9¾ in.
Pal. ant. (*andrewsi?*) of Upnor, young adult:	
Estimated height in the flesh	3934 mm. = 12 ft. 10⅞ in.
Lox. africana, adult:	
Height in the flesh.	3450 mm. = 11 ft. 3⅞ in.

The Pignataro Interamna specimen is several years older than the Upnor specimen, as indicated by the fact that the posterior ridge-plates of the second molar and the anterior ridge-plates of the third molar (Fig. 8) are in use, while in the Upnor specimen the ridge-plates of the second molar only are in use. Comparison with the growth of the large African elephant "Khartum" in the New York Zoological Park shows that in captive conditions at the age of twenty-seven years the animal grows three-quarters of an inch a year. By such an estimate the Pignataro Interamna adult is about five years older than the Upnor young adult; had it continued to increase in height, the fully adult bulls would measure about 13 ft. 6 in. in height, or two feet above the shoulder height of a large fully adult African bull elephant.

A more complete comparison of the Pignataro Interamna type with the types of Upnor, Kent, England, of San Isidro, Spain, and of north Germany will appear in the author's forthcoming monograph, in which full acknowledgments will be made of all the great contributions to our knowledge of the 'straight-tusked' elephant of Europe since the time of Hugh Falconer.

NOTE.—Shortly after the above description with its illustrations went to press, a separate of the extremely valuable and interesting article *"Der Waldelefant" von Steinheim an der Murr* (November, 1930) by Dr. F. Berckhemer reached the Osborn Library. This admirable description of the cranium of '*Elephas antiquus*' came too late for reference in the present article but fortunately not too late for inclusion in the author's forthcoming monograph on the Proboscidea, in which it is planned to treat the Italian and German crania side by side Palæontology is certainly indebted to Doctor Berckhemer of the Württemberg Society of Naturalists for this most welcome addition to our knowledge.

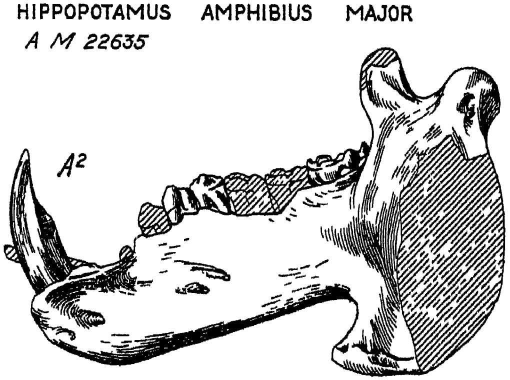


Fig. 17. Full-grown jaw of *Hippopotamus amphibius major* found in the gravels near the cranium and scapula of *Pal. ant. italicus*. Authorities differ as to whether the fossil *H. major* Cuv. is distinct from the living *H. amphibius* Linn.; accordingly *major* may be affixed as a subspecific term distinguishing the fossil species from the recent.